RF Power Transistors

Year 2000 Data Book

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RF Power Transistors
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About This Data Book

This volume is intended to replace the 1999 RF Power Transistors Data Book. It contains information on many devices in that volume, as well as ones introduced since that publication. Selected data sheets have been revised. In addition, we have included a full, updated Product Selection Guide, our newest package descriptions, and an updated list of our distributors and sales offices.

Products are listed in ascending order of frequency in both the Product Selection Guide and in the Data Sheets section. The Selection Guide will assist in choosing a device that meets the particular criteria—frequency, gain or output power or other—which you require in a component. To find a product for which the number is already known, turn to the Index on page 19.

The information contained in this book has been checked carefully, and is believed to be accurate. However, Ericsson Microelectronics assumes no responsibility for inaccuracies.

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Printed in U.S.A.

Design & Editing: Blair Northwood

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PRODUCT Number	FREQUENCY MHz	P_{OUT} Watts	GAIN dB	SUPPLY Voltage	PACKAGE Number	PAGE Number
***GOLDMOS™* FET**						
470 to 860 MHz • UHF TV Class A and AB						
PTF 10049	470-860	85	12	32	20240	33
PTF 10159	470-860	130	12	32/28	20240	39
850 to 1000 MHz						
PTF 10133	860-900	85	13	28	20237	47
PTF 10100	860-900	165	12	28	20250	53
PTF 10019	860-900	70	13	28	20237	61
PTF 10160*	860-900	85	15	26	20248	67
PTF 10020	860-960	125	11	28	20240	73
PTF 10149	921-960	70	15	26	20252	79
PTF 10036	860-960	85	11	28	20240	85
PTF 10162	860-960	18	14	26	20222	91
PTF 10136	1000	6	18	28	20244	99
PTF 10147	1000	10	15	26	20244	107
PTF 10137	1000	12	13	28	20244	113
PTF 10007	1000	35	12	28	20222	119
PTF 10052	1000	35	12	28	20235	125
PTF 10015	1000	50	12	28	20235	131
PTF 10031	1000	50	12	28	20222	137
PTF 10009	1000	85	12	28	20230	143

* Note: Specifications for this product are preliminary and subject to change without notice. Please contact your sales representative for further product information. Complete product infromation is available on our Website at: www.ericsson.com/rfpower.

PRODUCT Number	FREQUENCY MHz	P_{OUT} Watts	GAIN dB	SUPPLY Voltage	PACKAGE Number	PAGE Number
1000 to 2000 MHz • PCS/PCN						
PTF 10111	1500	6	15	28	20222	151
PTF 10135	2000	5	11	26	20249	157
PTF 10041*	2000	12	10	26	20249	163
PTF 10053	2000	12	10	26	20244	167
PTF 10107	2000	5	11	26	20244	171
PTF 10021	1400-1600	30	11	28	20237	177
PTF 10125	1400-1600	135	11.5	28	20250	183
PTF 10045	1600-1650	30	10	28	20222	189
PTF 10112	1800-2000	60	11	28	20248	195
PTF 10153*	1800-2000	60	11.5	28	20248	201
PTF 10120	1800-2000	120	10	28	20250	205
PTF 10043	1900-2000	12	11	26	20222	211
PTF 10035	1900-2000	30	11	28	20237	217
2100 to 2200 MHz • W-CDMA						
PTF 10119	2100-2200	12	10	28	20222	223
PTF 10048	2100-2200	30	10	28	20237	227
PTF 10122	2100-2200	50	10	28	20248	233
PTF 10134*	2100-2200	100	10	28	20250	239
Bipolar						
400 to 500 MHz • Wireless, Mobile Base Stations, and Paging						
PTB 20204	380-500	1	12.5	24	20227	247
PTB 20200	500	30	10	24	20200	251
PTB 20031	420-470	40	8	24	20200	255

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PRODUCT Number	FREQUENCY MHz	P_{OUT} Watts	GAIN dB	SUPPLY Voltage	PACKAGE Number	PAGE Number
470 to 860 MHz • UHF TV Class A and AB						
PTB 20091	470-860	30	11	25	20212	257
PTB 20081	470-860	150	8.5	28	20212	259
PTB 20101	470-860	175	10	28	20224	263
PTB 20190	470-800	175	8	28	20224	267
850 to 900 MHz						
PTB 20155	600-960	9	8	28	20209	271
PTB 20166	675-925	23	8	24-30	20209	275
PTB 20006	860-900	4	11	25	20201	279
PTB 20005	860-900	15	9	25	20201	283
PTB 20038	860-900	25	9	25	20200	287
PTB 20134	860-900	30	8	25	20201	289
PTB 20004	860-900	50	8	25	20200	291
PTB 20053	860-900	60	8	25	20200	295
PTB 20111	860-900	85	8.5	25	20216	299
PTB 20017	860-900	150	8	25	20224	303
PTB 20189	900-960	1	12	25	20227	307
PTB 20003	915-960	4	11	25	20201	311
PTB 20181	915-960	6	9	25	20227	315
PTB 20220	915-960	15	8	25	20232	319
PTB 20105	925-960	20	9	25	20201	323
PTB 20171	935-960	25	10	24	20200	327
PTB 20097	915-960	40	8.5	25	20200	329
PTB 20148	925-960	60	8	25	20200	333

PRODUCT Number	FREQUENCY MHz	P_{OUT} Watts	GAIN dB	SUPPLY Voltage	PACKAGE Number	PAGE Number
PTB 20219	925-960	70	8.5	26	20216	337
PTB 20135	925-960	85	8	26	20216	341
PTB 20177	925-960	150	7.5	26	20224	345
1000 to 1850 MHz						
PTB 20156	1350-1850	8	6	22	20209	351
PTB 20157	1350-1850	20	6	22-26	20209	355
PTB 20248	1465-1513	0.7	10	26	20227	359
PTB 20046	1465-1513	1	10.5	26	20201	363
PTB 20249	1465-1513	2.5	9.5	26	20227	365
PTB 20051	1465-1513	6	8	26	20201	369
PTB 20239	1465-1513	12	8	26	20232	371
PTB 20074	1465-1513	14	7	26	20201	375
PTB 20141	1465-1513	18	8.5	23	20201	377
PTB 20124*	1465-1513	40	7	26	20209	379
PTB 20202	1465-1513	125	8	26	20225	385
PTB 20077	1525-1660	0.7	10	26	20227	389
PTB 20078	1525-1660	2.5	9	26	20227	393
PTB 20228	1600-1700	6.5	8.5	26	20227	397
PTB 20079	1600-1700	10	9	26	20209	401
PTB 20080	1600-1700	25	9	26	20209	405
1000 to 2000 MHz • PCS/PCN						
PTB 20179	1800-2000	0.4	8	25	20227	409
PTB 20180	1800-2000	2.5	8	26	20227	413
PTB 20216	1800-2000	6	8	26	20227	415

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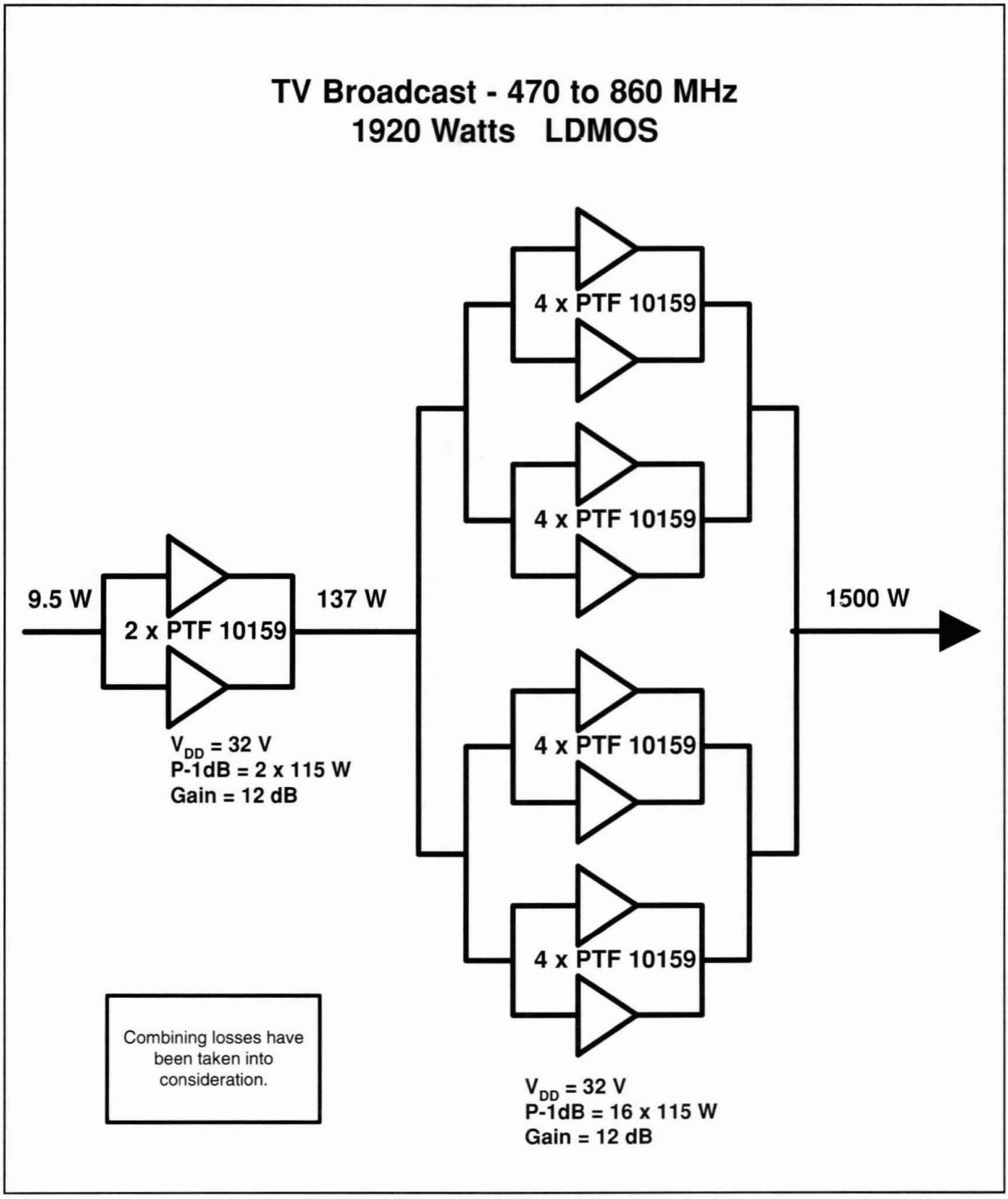
PRODUCT Number	FREQUENCY MHz	P_{OUT} Watts	GAIN dB	SUPPLY Voltage	PACKAGE Number	PAGE Number
PTB 20264	1900-2000	10	8.4	26	20243	417
PTB 20082	1800-2000	10	8	26	20209	421
PTB 20170	1800-2000	30	7	26	20209	425
PTB 20151	1800-2000	45	8	26	20223	431
PTB 20175	1900-2000	55	7	26	20223	437
PTB 20230	1800-2000	45	8.5	26	20234	441
PTB 20125	1800-2000	100	7	26	20225	445
2100 to 2200 MHz • W-CDMA						
PTB 20231*	2100-2200	18	8	26	20209	451
PTB 20245	2100-2200	35	7.5	26	20223	457
PTB 20235	2100-2200	70	8	26	20225	463
50-Ω Hybrid						
Single-Stage						
PTH 31001*	1800-1900	30	12	28	A	471
PTH 31042	1900-2000	10	12	28	A	475
PTH 31002	1900-2000	30	12	28	A	479
Dual-Stage 50-Ω Hybrid						
PTH 32003	1930-1990	25	24	26	J	483

Applications


TV Broadcast - 470 to 860 MHz
1920 Watts LDMOS
9.5 W
2 x PTF 10159
137 W
4 x PTF 10159
4 x PTF 10159
4 x PTF 10159
4 x PTF 10159
1500 W
V_{DD} = 32 V
P-1dB = 2 x 115 W
Gain = 12 dB
Combining losses have been taken into consideration.
V_{DD} = 32 V
P-1dB = 16 x 115 W
Gain = 12 dB

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Applications

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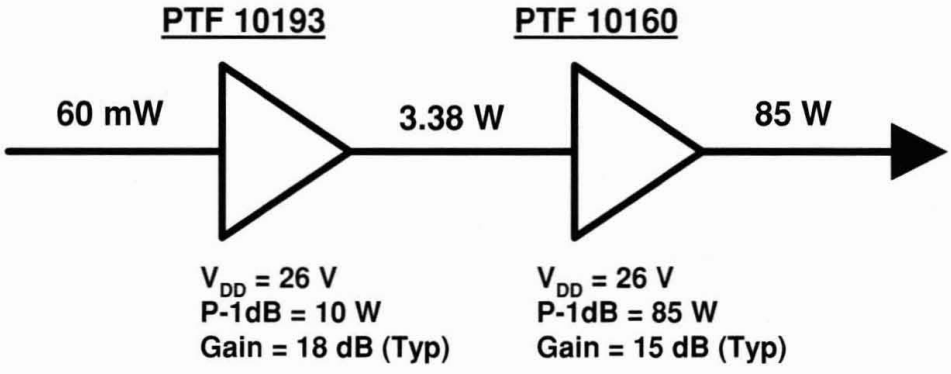
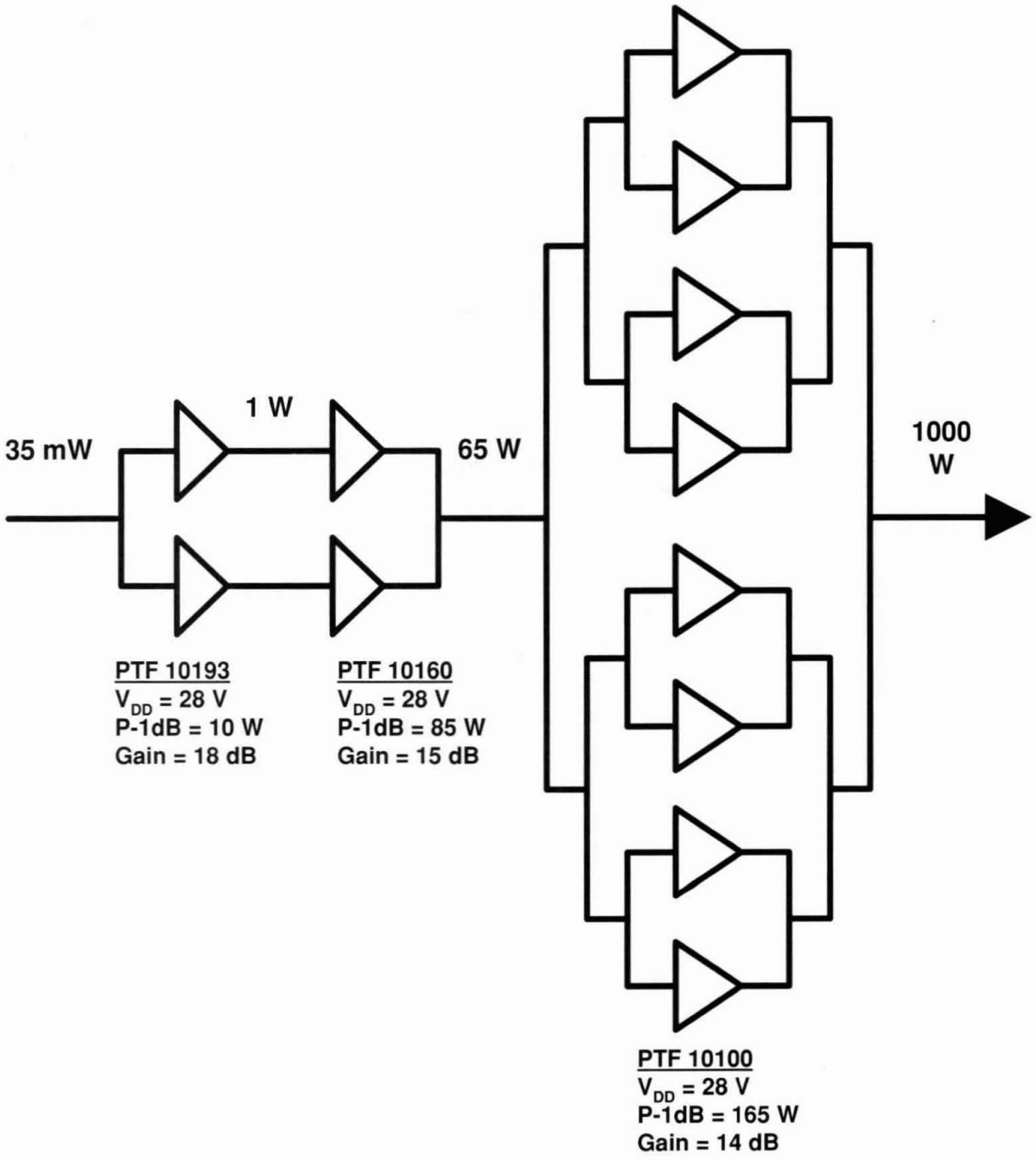
AMPS/ D-AMPS/ GSM - 860 to 960 MHz
85 Watts LDMOS



Applications

MCPA/ D-AMPS - 920 to 960 MHz
1000 Watts LDMOS



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Applications

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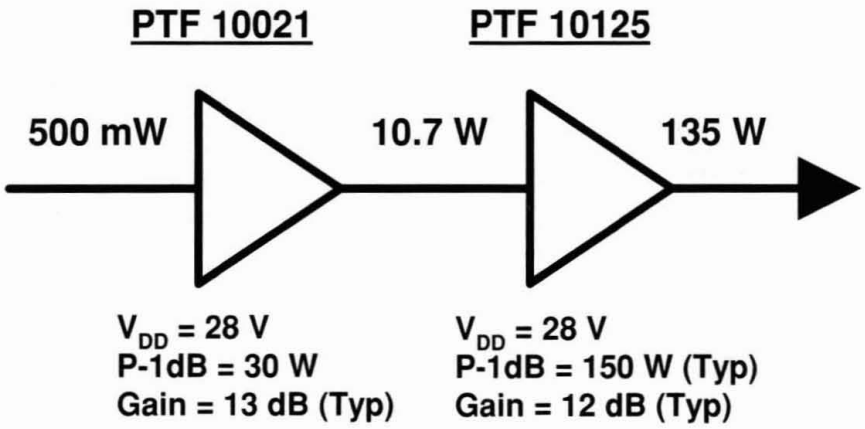
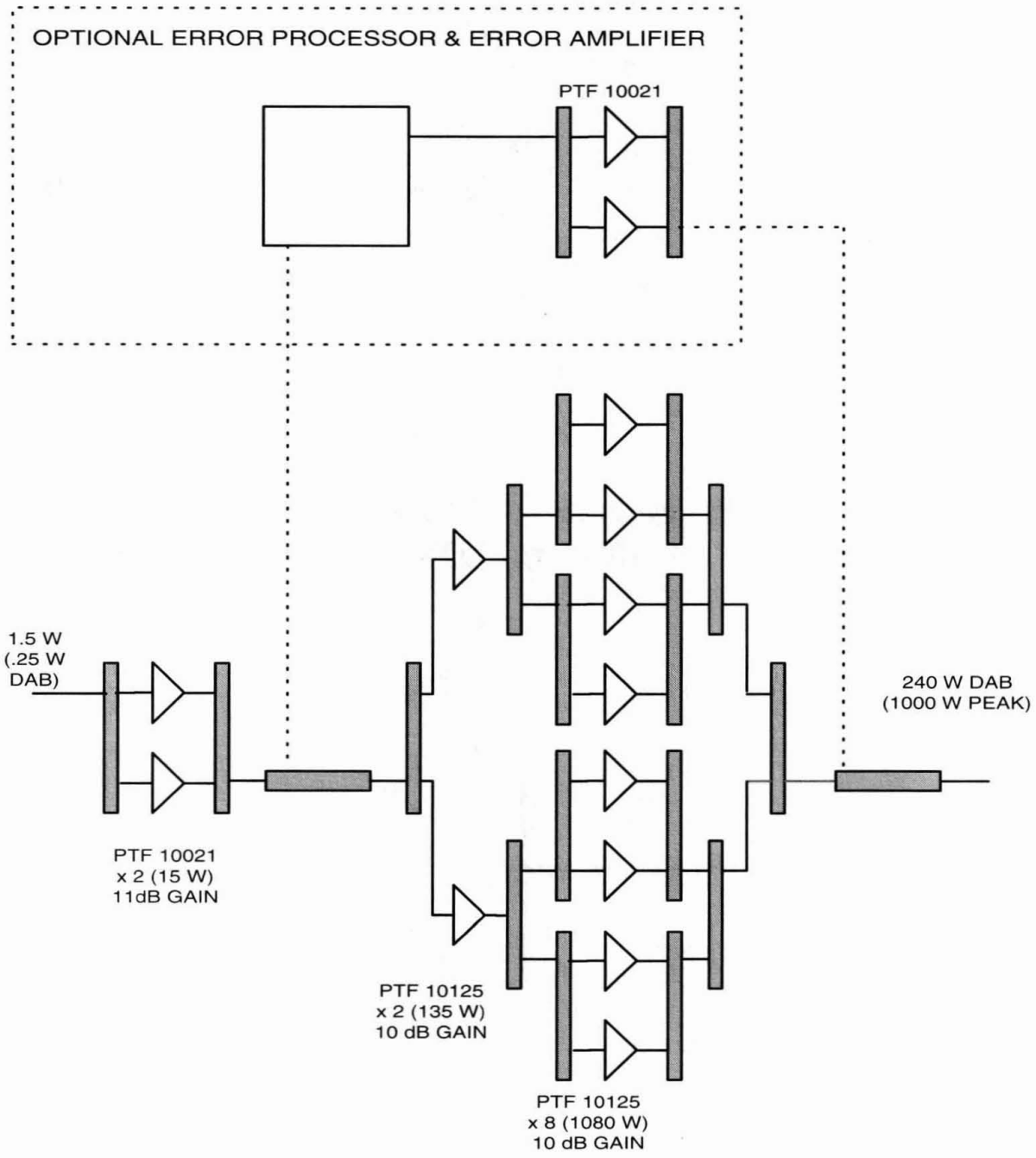
DAB - 1.45 to 1.55 GHz
135 Watts LDMOS



Applications

DAB - 1.45 to 1.55 GHz
240 Watts LDMOS



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Applications

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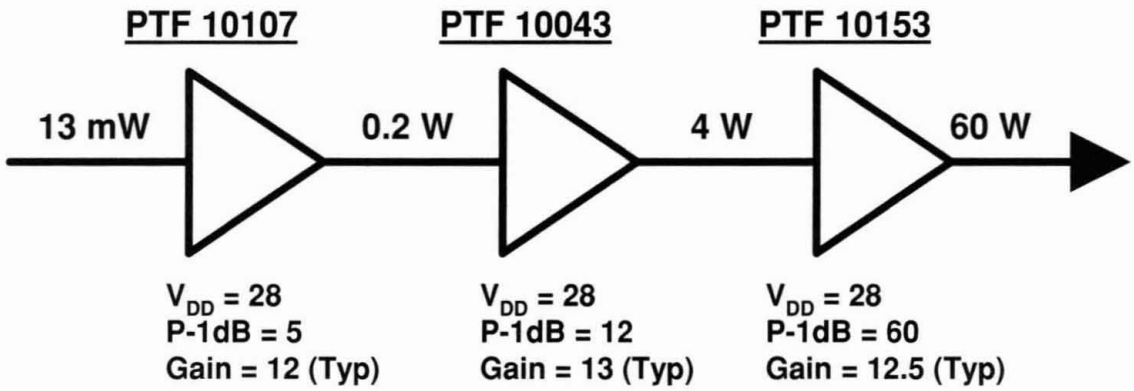
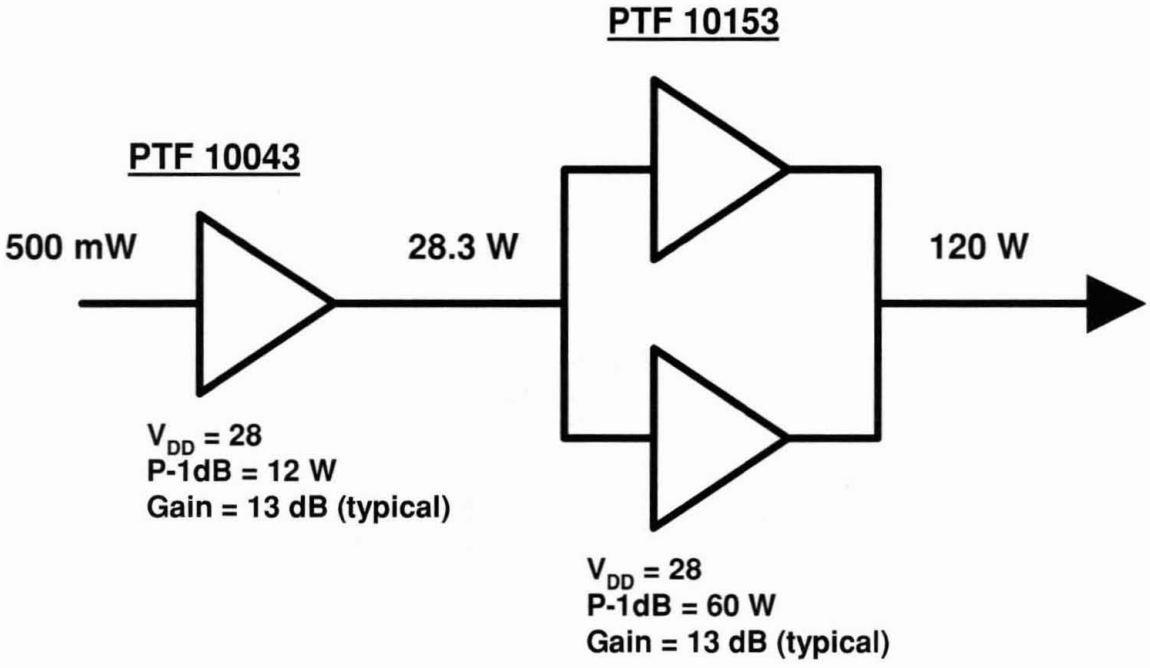
PCS - 1.8 to 2.0 GHz
60 Watts LDMOS

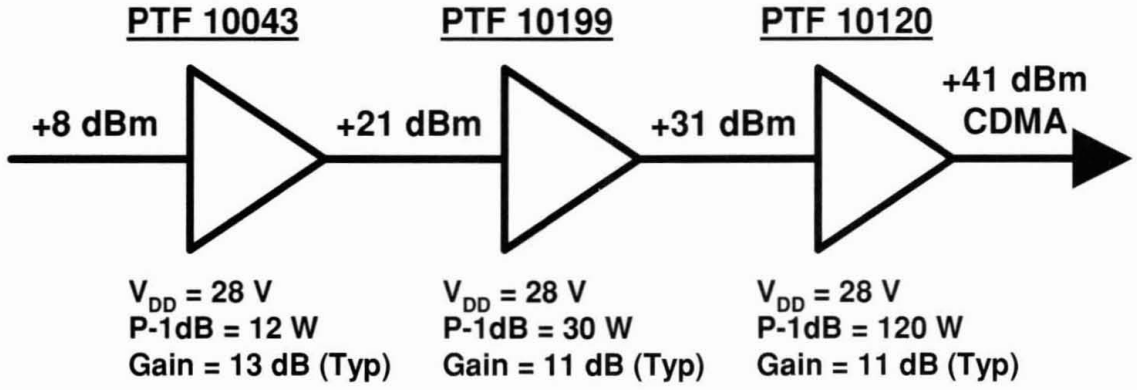


GSM EDGE - 1.8 to 2.0 GHz
120 Watts LDMOS

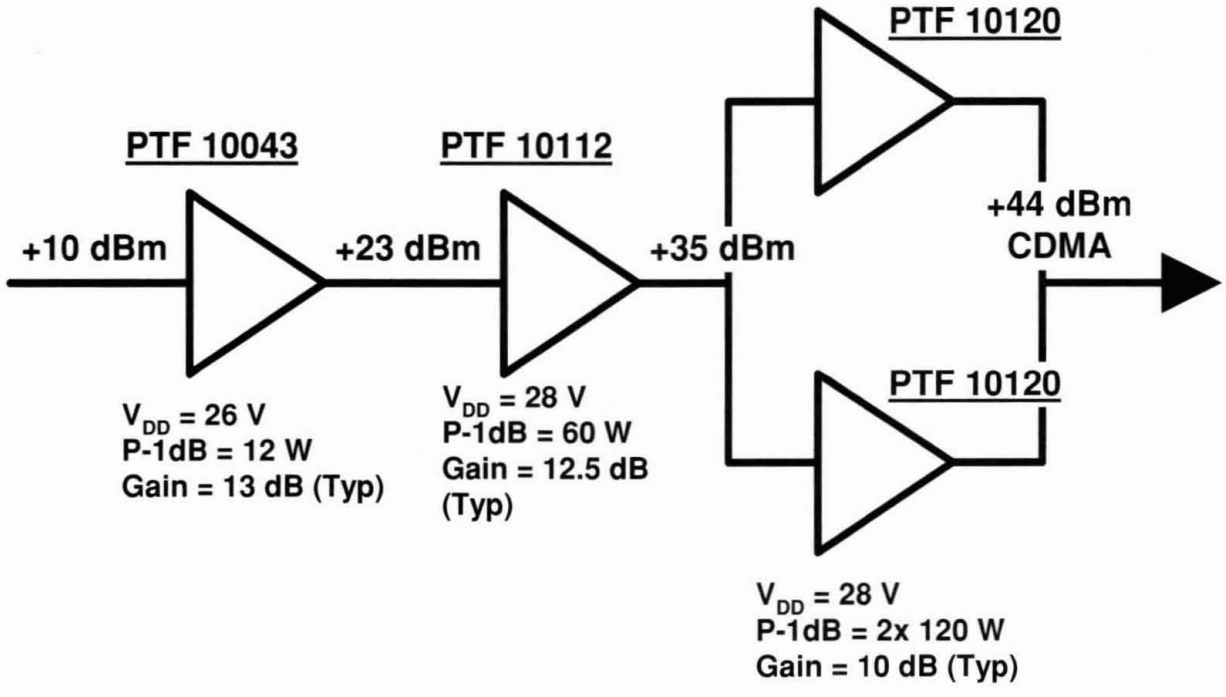


Applications

PCS - 1.9 to 2.0 GHz
120 Watts LDMOS



PCS - 1.9 to 2.0 GHz
240 Watts LDMOS



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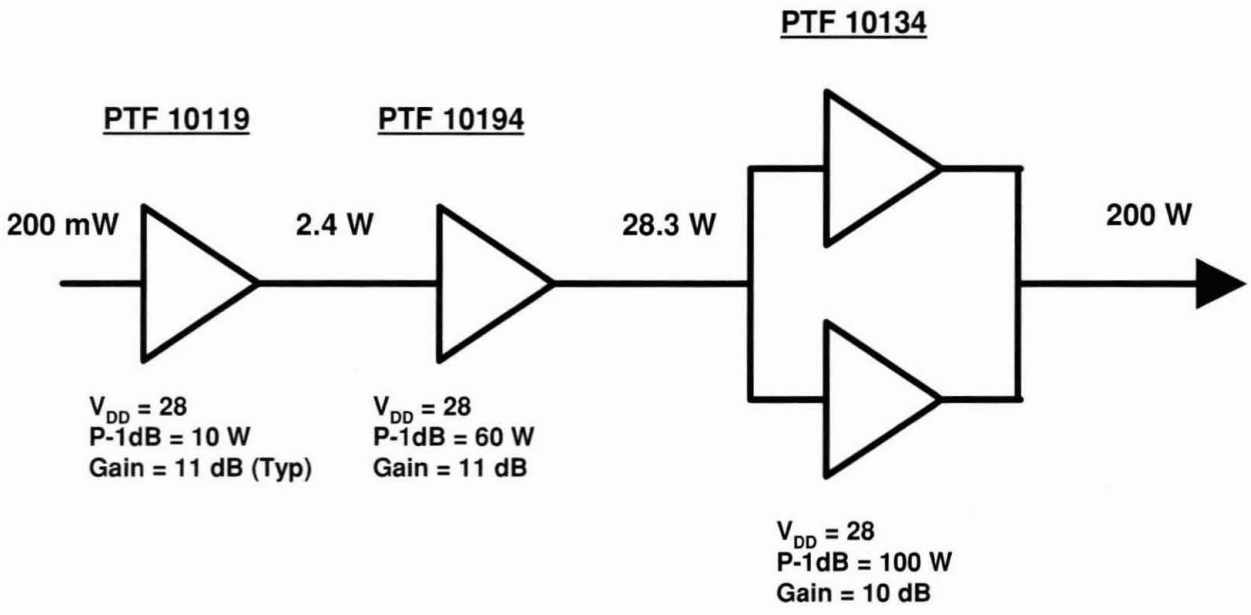
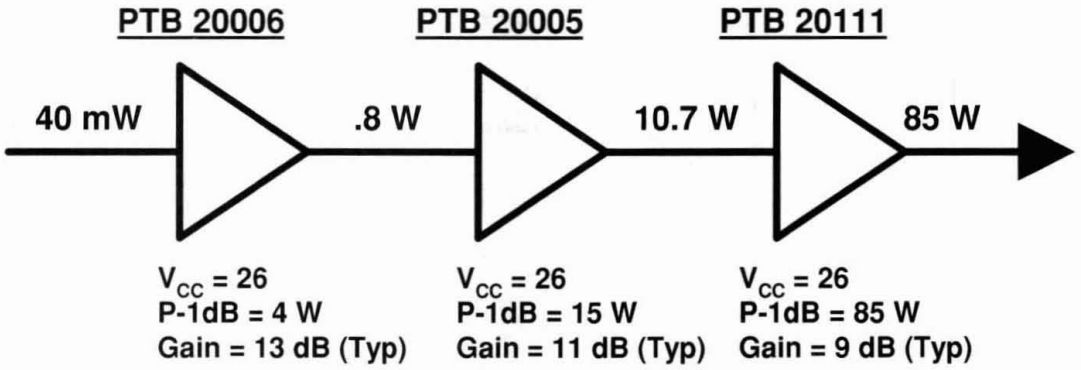
Applications

WCDMA - 2.11 to 2.17 GHz
200 Watts LDMOS

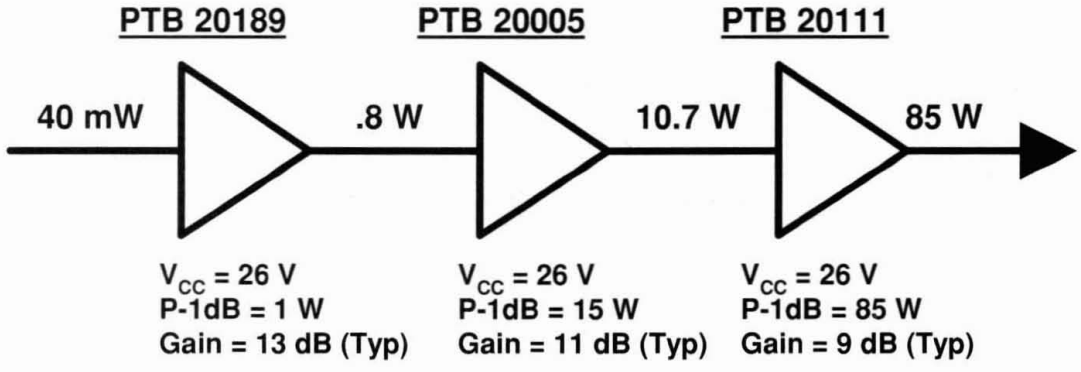


Applications

AMPS/ D-AMPS - 860 to 960 MHz
85 Watts Bipolar



GSM - 900 MHz
85 Watts Bipolar



Applications

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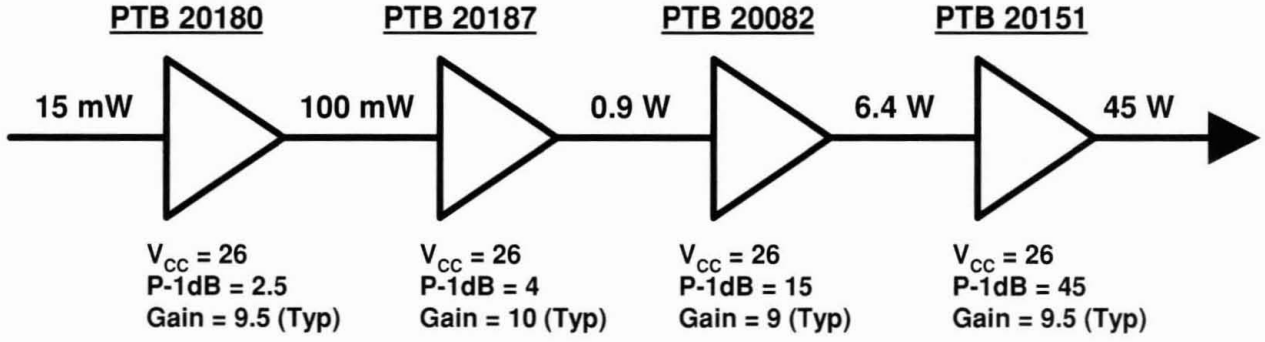
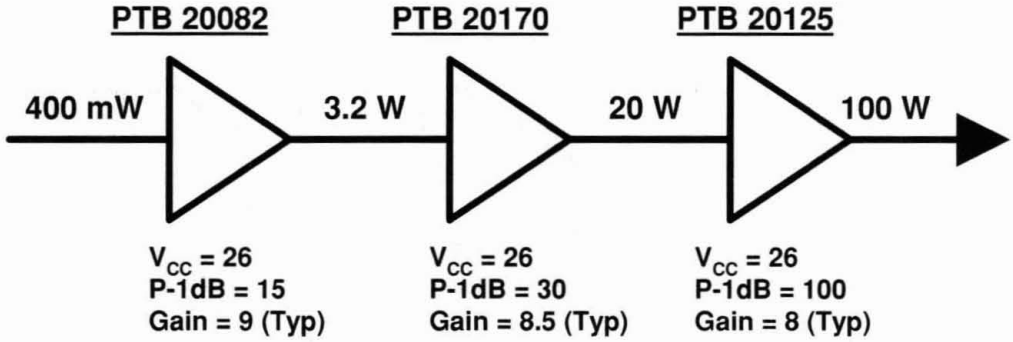
PCS - 1.8 to 2.0 GHz
45 Watts Bipolar



PCS - 1.8 to 2.0 GHz
100 Watts Bipolar



Decibels - Volts - Watts Conversion Table

50-0hm System Terminated

dBm	V	P_{OUT}
+53	100.0	200 W
+50	70.7	I00 W
+49	64.0	80 W
+48	58.0	64 W
+47	50.0	50 W
+46	44.5	40 W
+45	40.0	32 W
+44	32.5	25 W
+43	32.0	20 W
+42	28.0	16 W
+41	26.2	12.5 W
+40	22.5	10 W
+39	20.0	8 W
+38	18.0	6 .4 W
+37	16.0	5 W
+36	14.1	4 W
+35	12.5	3.2 W
+34	11.5	2.5 W
+33	10.0	2 W
+32	9.0	1.6 W
+31	8.0	1.25 W
+30	7.10	1.0 W

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PRODUCT Number	FREQUENCY MHz	P_{OUT} Watts	GAIN dB	SUPPLY Voltage	PACKAGE Number	PAGE Number
***GOLDMOS™* FET**						
PTF 10007	1000	35	12	28	20222	119
PTF 10009	1000	85	12	28	20230	143
PTF 10015	1000	50	12	28	20235	131
PTF 10019	860-900	70	13	28	20237	61
PTF 10020	860-960	125	11	28	20240	73
PTF 10021	1400-1600	30	11	28	20237	177
PTF 10031	1000	50	12	28	20222	137
PTF 10035	1900-2000	30	11	28	20237	217
PTF 10036	860-960	85	11	28	20240	85
PTF 10041*	2000	12	10	26	20249	163
PTF 10043	1900-2000	12	11	26	20222	211
PTF 10045	1600-1650	30	10	28	20222	189
PTF 10048	2100-2200	30	10	28	20237	227
PTF 10049	470-860	85	12	32	20240	33
PTF 10052	1000	35	12	28	20235	125
PTF 10053	2000	12	10	26	20244	167
PTF 10100	860-900	165	12	28	20250	53
PTF 10107	2000	5	11	26	20244	171
PTF 10111	1500	6	15	28	20222	151
PTF 10112	1800-2000	60	11	28	20248	195

* Note: Specifications for this product are preliminary and subject to change without notice. Please contact your sales representative for further product information. Complete product infromation is available on our Website at: www.ericsson.com/rfpower.

PRODUCT Number	FREQUENCY MHz	P_{OUT} Watts	GAIN dB	SUPPLY Voltage	PACKAGE Number	PAGE Number
PTF 10119	2100-2200	12	10	28	20222	223
PTF 10120	1800-2000	120	10	28	20250	205
PTF 10122	2100-2200	50	10	28	20248	233
PTF 10125	1400-1600	135	11.5	28	20250	183
PTF 10133	860-900	85	13	28	20237	47
PTF 10134*	2100-2200	100	10	28	20250	239
PTF 10135	2000	5	11	26	20249	157
PTF 10136	1000	6	18	28	20244	99
PTF 10137	1000	12	13	28	20244	113
PTF 10147	1000	10	15	26	20244	107
PTF 10149	921-960	70	15	26	20252	79
PTF 10153*	1800-2000	60	11.5	28	20248	201
PTF 10159	470-860	130	12	32/28	20240	39
PTF 10160*	860-900	85	15	26	20248	67
PTF 10162	860-960	18	14	26	20222	91
Bipolar Transistor						
PTB 20003	915-960	4	11	25	20201	311
PTB 20004	860-900	50	8	25	20200	291
PTB 20005	860-900	15	9	25	20201	283
PTB 20006	860-900	4	11	25	20201	279
PTB 20017	860-900	150	8	25	20224	303
PTB 20031	420-470	40	8	24	20200	255

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PRODUCT Number	FREQUENCY MHz	P_{OUT} Watts	GAIN dB	SUPPLY Voltage	PACKAGE Number	PAGE Number
PTB 20038	860-900	25	9	25	20200	287
PTB 20046	1465-1513	1	10.5	26	20201	363
PTB 20051	1465-1513	6	8	26	20201	369
PTB 20053	860-900	60	8	25	20200	295
PTB 20074	1465-1513	14	7	26	20201	375
PTB 20077	1525-1660	0.7	10	26	20227	389
PTB 20078	1525-1660	2.5	9	26	20227	393
PTB 20079	1600-1700	10	9	26	20209	401
PTB 20080	1600-1700	25	9	26	20209	405
PTB 20081	470-860	150	8.5	28	20212	259
PTB 20082	1800-2000	10	8	26	20209	421
PTB 20091	470-860	30	11	25	20212	257
PTB 20097	915-960	40	8.5	25	20200	329
PTB 20101	470-860	175	10	28	20224	263
PTB 20105	925-960	20	9	25	20201	323
PTB 20111	860-900	85	8.5	25	20216	299
PTB 20124*	1465-1513	40	7	26	20209	379
PTB 20125	1800-2000	100	7	26	20225	445
PTB 20134	860-900	30	8	25	20201	289
PTB 20135	925-960	85	8	26	20216	341
PTB 20141	1465-1513	18	8.5	23	20201	377
PTB 20148	925-960	60	8	25	20200	333

PRODUCT Number	FREQUENCY MHz	P_{OUT} Watts	GAIN dB	SUPPLY Voltage	PACKAGE Number	PAGE Number
PTB 20151	1800-2000	45	8	26	20223	431
PTB 20155	600-960	9	8	28	20209	271
PTB 20156	1350-1850	8	6	22	20209	351
PTB 20157	1350-1850	20	6	22-26	20209	355
PTB 20166	675-925	23	8	24-30	20209	275
PTB 20170	1800-2000	30	7	26	20209	425
PTB 20171	935-960	25	10	24	20200	327
PTB 20175	1900-2000	55	7	26	20223	437
PTB 20177	925-960	150	7.5	26	20224	345
PTB 20179	1800-2000	0.4	8	25	20227	409
PTB 20180	1800-2000	2.5	8	26	20227	413
PTB 20181	915-960	6	9	25	20227	315
PTB 20189	900-960	1	12	25	20227	307
PTB 20190	470-800	175	8	28	20224	267
PTB 20200	380-500	30	10	24	20200	251
PTB 20202	1465-1513	125	8	26	20225	385
PTB 20204	380-500	1	12.5	24	20227	247
PTB 20216	1800-2000	6	8	26	20227	415
PTB 20219	925-960	70	8.5	26	20216	337
PTB 20220	915-960	15	8	25	20232	319
PTB 20228	1600-1700	6.5	8.5	26	20227	397
PTB 20230	1800-2000	45	8.5	26	20234	441

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PRODUCT Number	FREQUENCY MHz	P_{OUT} Watts	GAIN dB	SUPPLY Voltage	PACKAGE Number	PAGE Number
PTB 20231*	2100-2200	18	8	26	20209	451
PTB 20235	2100-2200	70	8	26	20225	463
PTB 20239	1465-1513	12	8	26	20232	371
PTB 20245	2100-2200	35	7.5	26	20223	457
PTB 20248	1465-1513	0.7	10	26	20227	359
PTB 20249	1465-1513	2.5	9.5	26	20227	365
PTB 20264	1900-2000	10	8.4	26	20243	417
Dual-Stage 50-Ω Hybrid						
Single-Stage						
PTH 31001*	1800-1900	30	12	28	A	471
PTH 31002	1900-2000	30	12	28	A	479
PTH 31042	1900-2000	10	12	28	A	475
Dual-Stage						
PTH 32003	1930-1990	25	24	26	J	483

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Gain and P-1dB Specifications

In today's market the applications in which RF Power Transistors are utilized are more varied than ever. TDMA, CDMA, and other complex modulation schemes such as television require data sheets with different information than the traditional "Gain at a fixed Power Output" specification that most RF Power Transistor Data Sheets offer. For this reason many of our newer Data Sheets have specifications which may, at first, seem strange.

A data sheet which specifies minimum 8 dB gain at 40 watts output power contains no information about how compressed the device is at 40 watts. It is possible this device has 11 dB of gain at both 5 and 10 watts output power and 8 dB of gain at 40 watts output. This means it is 3 dB compressed at 40 watts. For many CW applications this much information may be okay, but for applications in which complex modulation is used it is not.

For applications in which complex modulation is used the information most desired is the not-significantly-gain-compressed peak power capability, and the gain at a reduced power level (efficiency at this reduced power level is also of more interest than the efficiency at a highly compressed power level, where it will naturally be better).

In these applications there may be several randomly phased signals which operate at a very low average power. The important parameters for transistors used to amplify this type of signal are gain at this low average power and the power at which the gain of the devices begins to significantly compress (because this is also the point where linearity begins to degrade dramatically). For this reason, many of our data sheets specify the minimum power output capability at which a device is 1 dB compressed and the gain of the device at a reduced power level. Efficiency may also be specified at this reduced power level.

ERICSSON

Quality and High Reliabiltiy

Prepared by Nancie Barker, Quality Assurance Manager, Ericsson RF Power Products

Producing high quality, highly reliable semiconductor devices poses many challenges for a device manufacturer. At Ericsson RF Power, we rise to those challenges with facilities and personnel dedicated to superior reliability high-yield production technology. In order to ensure the highest reliability, ERICSSON uses the GOLDMOS™ process to minimize any problems due to electromigration of the semiconductor metallization structures. Utilizing a gold structure on the die and capacitor, gold bonding wire and gold on the package interconnects ensures that no intermetallics are formed, thus improving long term reliability.

ERICSSON RF POWER is dedicated to the manufacture of the highest quality, most reliable products in the RF Power marketplace. We work hard to ensure that every product that we ship meets or exceeds customer expectation.

At Ericsson, quality is every employee's responsibility. Each employee, whether production operator, sales representative, design engineer or other employee is required to inspect their own work to ensure that each operation meets our high standards of excellence. Additionally, our quality department monitors raw materials, processes and products and performs internal audits to verify that the quality standards of each department are met. Ericsson believes that it is equally important to have well trained personnel, state of the art equipment, and the higher quality raw materials. Our product is only as good as what we put into it, and that means the correct software, supportive human resources, engineering design, production planning, correct test equipment and quality raw materials. By ensuring that quality is embedded in the entire operation, we know that, not only will the product be of the highest quality, but the documentation will be correct, the order will be entered correctly and billed properly and the shipping container and labels will be correct, protecting the device from damage, environmental degradation or electrostatic discharge.

The Quality staff at ERICSSON, working closely with other Ericsson teams, sets the standards to ensure that the needs of the customer are met and to ensure verification of the manufacturing process. Quality planning is part of the overall annual business review for ERICSSON RF Power. Additionally, the Quality team is involved in the development of each new product to ensure that quality is designed in and will be manufacturable to the highest quality standards. The quality team additionally reviews all customer specifications, monitors and approves all new documentation and integrates them into the manufacturing/inspection process.

For more information on testing procedures and high reliability capabilities contact the Quality Assurance Department at the Ericsson RF Power facility in Morgan Hill, California, U.S.A.

MANUFACTURING REQUIREMENTS FOR BIPOLAR AND FET DEVICES

PROCESS STEP	REFERENCE
Wafer Evaluation Wafer Saw Die Inspection	**Ericsson 21-046** Ericsson Specification Mil Std 750-2073
External Visual (Package) Die Attach	Mil Std 750-2071 Ericsson Product Wire Bond Diagram
Die Attach Evaluation Wire Bond	Ericsson 21-148 Ericsson Product Wire Bond Diagram
Internal Visual Seal	Mil Std 750-2072 Ericsson Specificaiton 21-154
Gross Leak	Mil Std 750-1071, Cond. D
DC Test RF Test DC Test	Ericsson Specification 21-154 Ericsson Specification 21-153 Ericsson Specification 21-154
Mark Fianl QA Inspection Packing Shipping	Ericsson Specification 21-165 Mil Std 750-2071 Ericsson Specification 21-163 Ericsson Specification 21-162

Semiconductor Manufacturing and Process Control

ERICSSON's processing is performed at our new, modern, 50,000 sq. ft. manufacturing facility by the most experienced and highly trained team in the industry. Strict process control inspections after every manufacturing operation ensure that QUALITY IS BUILT INTO ERICSSON's PRODUCTS. The ERICSSON Quality Assurance Team continuously monitors all operations from incoming raw materials to product shipment.

All devices are manufactured under documented procedures utilizing highly trained personnel. Each work order specifies every process step. Operators enter data after each process step.

ERICSSON is an ISO 9001 certified facility. Device processing is in accordance with MIL-S-19500.

The Reliability Program

ERICSSON's Reliability Program includes a series of product stress-level tests, environmental and mechanical reliability tests, and high temperature performance tests. These tests are performed during new product qualification and are sampled throughout the product life.

The purpose of this program is two-fold. It continuously verifies that ERICSSON products are compliant with required standards, and it identifies potential problems. The system requires root cause analysis if there is a failure or change in performance, followed by immediate corrective and preventive action.

RELIABILITY REQUIREMENTS FOR DISCRETE BIPOLAR AND FET DEVICES

TEST DESCRIPTION	REFERENCE	QUALITY CONFORMANCE	LOCATION
External Visual	MilStd 750-2071	AQL 0.15/0, 4/1.0 Critical/Major/Minor	Internal
Mechanical Dimensions	Product Specifications	AQL0.1	Internal
Coplanarity (As Applicable)	MilStd 1835	AQL 0.1/S4	Internal
Gross Leak	MilStd 750-1071	LTPD 30 (8 pcs)	External
Resistance to Solvents	Mil Std 750-1022	LTPD 30 (8 pcs)	External
Internal Visual	Mil Std 750-2070	LTPD 50 (pcs)	Internal
Bond Strength	Mil Std 750-2037	LTPD 10 (22 wires)	Internal
Die Shear Strength	Mil Std 750-2017	LTPD 50 (5)	External
Subgroup 1			
Solderability	Mil Std 750-2026	LTPD 20 (11)	External
Resistance to Solder	Mil Std 750-2031	LTPD 30 (8)	External
Subgroup 2			
High Temperature Life	MilStd 750-1031 (340 hrs)	LTPD 5 (45)	External
Hermeticity			
Gross Leak	Mil Std 750-1071 Condition C		External
DC End Points	As specified		Internal
Subgroup 3			
Temperature Cycling	Mil Std 750-1051 Condition F (45X)	LTPD 5 (45)	External
Hermeticity			
Gross Leak	Mil Std 750-1071 Condition C		External
Vapor Phase (Solder)	Mil Std 202-103		External
DC End Points	As specified		Internal
Subgroup 4			
Shock 1500g	MilStd 750-2016	LTPD 30 (8)	External
Vibration 20g	MilStd 750-2056		External
Acceleration 10,000	MilStd 750-2006		External
Hermeticity			
Gross Leak	MilStd 750-1071 Condition C		External
DC End Points	As specified		Internal
Subgroup 5			
Steady State Op. Life	MilStd 750-1027 1000 hrs. (R/R @ 0, 340, 660, 1000)	LTPD 7 (32)	Internal
DC End Points	As Specified		Internal

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RELIABILITY REQUIREMENTS FOR HIT PRODUCTS

TEST DESCRIPTION	REFERENCE	QUALITY CONFORMANCE	LOCATION
External Visual	Mil Std 883-2009	AQL 0.15/0, 4/1.0 Critical/Major/Minor	Internal
Mechanical Dimensions	Product Specifications	AQL0.1	Internal
Coplanarity (As Applicable)	Mil Std 1835	AQL 0.1/S4	Internal
Gross Leak	Mil Std 883-1014	LTPD 30 (8 pcs)	External
Resistance to Solvents	Mil Std 883-2015	LTPD 30 (8 pcs)	External
Internal Visual	Mil Std 883-2017	LTPD 50 (pcs)	Internal
Bond Strength	Mil Std 883-2011	LTPD 10 (22 wires)	Internal
Die Shear Strength	Mil Std 883-2019	LTPD 50 (5)	External
Subgroup 1			
Solderability	Mil Std 883-2003	LTPD 20 (11)	External
Subgroup 2			
High Temperature Life Hermeticity	Mil Std 883/1008 (340 hrs) @75°C	LTPD 5 (45)	External
Gross Leak	Mil Std 883-1014 Condition C		External
RF End Points	As specified		Internal
Subgroup 3			
Temperature Cycling Hermeticity	Mil Std 883-1010	LTPD 5 (45)	External
Gross Leak	Mil Std 883-1014 Condition C		External
RF End Points	As specified		Internal
Subgroup 4			
Shock 1500g	Mil Std 883-2002, Cond B		External
Vibration 20g	Mil Std 883-2007, Cond. A		External
Acceleration 10,000	Mil Std 750-2006		External
Hermeticity	Mil Std 883-2001,Cond.-E		
Gross Leak	Mil Std 883-1014 Condition C		External
RF End Points	As specified		Internal
Subgroup 5			
Steady State Op. Life	Mil Std 883-1005 1000 hrs. (R/R @ 0, 340, 660, 1000)	LTPD 7 (32)	External
RF End Points	As Specified		Internal

The Positive Traceability Program

Ericsson retains traceability for each manufacturing lot. Each production lot shows the entire manufacturing production lot, packaging material lot, machine number used at each manufacturing step, operator identification and final inspection sign-off. Records are retained for at least 5 years. Each device is permanently marked with the manufacturing lot (work order) number. The lot, in turn, is traceable to a data package containing all manufacturing history.

Post-Production Screening

One hundred percent visual and electrical screening, both RF and DC testing, of finished product is performed to guarantee that products comply with the customer-supplied specification or standard part data sheet.

Final test accuracy and repeatability is assured by the use of dedicated test fixtures and correlation units. All test set-ups are verified with the correlation units prior to the start of testing.

Qualification Tests

All new raw materials, die, capacitors and new devices must pass rigorous qualification tests prior to release to production. Additionally, any major change requires requalification.

Change Control

Any major change requires customer notification and customer approval. All documentation is under control and there is a documented procedure for product change.

Failure Analysis

Extensive failure analysis is performed on non-conforming devices. The information derived from this is utilized to develop corrective and preventive action resulting in a more robust device. The results of the analysis, complete with photomicrographs, and all data are kept in our quality assurance files for future reference.

Failure analysis is a postmortem examination of a failed device employing electrical measurements and many analytical techniques of physics, metallurgy and chemistry to identify the mode or mechanism causing the failure. This is referred to as the "physics–of–failure approach to reliability." The failure analysis procedure at Ericsson is designed to determine the specific cause of failure and initiate a corrective action in manufacturing or device design to eliminate the cause and prevent the recurrence of the failure.

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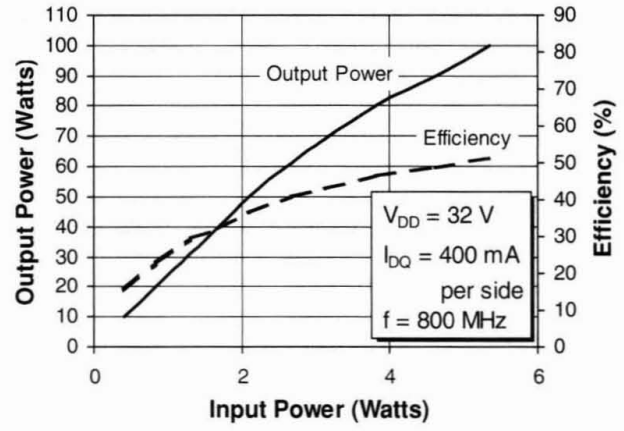
PTF 10049
85 Watts, 470–860 MHz
GOLDMOS™ Field Effect Transistor

Description

The PTF 10049 is an internally matched, common source, N-channel enhancement-mode lateral MOSFET intended for large signal television amplifier applications in the 470 to 860 MHz band. It is rated at 85 watts power output. Nitride surface passivation and full gold metallization ensure excellent device lifetime and reliability.

- ***INTERNALLY MATCHED***
- **Performance at 800 MHz, 32 Volts**
  - **Output Power = 85 Watts**
  - **Power Gain = 13.5 dB Typ**
  - **Efficiency = 58% Typ**
- **Full Gold Metallization**
- **Silicon Nitride Passivated**
- **Excellent Thermal Stability**
- **100% Lot Traceability**

Typical Output Power and Efficiency vs. Input Power



Package 20240

RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Common Source Power Gain (V_{DD} = 32 V, P_{OUT} = 30 W, I_{DQ} = 400 mA per side, f = 800 MHz)	G_{ps}	12.0	13.5	—	dB
Power Output at 1 dB Compression (V_{DD} = 32 V, I_{DQ} = 400 mA per side, f = 800 MHz)	P-1dB	85	100	—	Watts
Drain Efficiency (V_{DD} = 32 V, P_{OUT} = 85 W, I_{DQ} = 400 mA per side, f = 800 MHz)	η_D	52	58	—	%
Distortion (V_{DD} = 32 V, P_{OUT} = 85 W(PEP), I_{DQ} = 400 mA per side, f_1 = 800 MHz, f_2 = 801 MHz)	IMD_3	–30	–35	—	dBc
Load Mismatch Tolerance (V_{DD} = 32 V, P_{OUT} = 42.5 W, I_{DQ} = 400 mA per side, f = 800 MHz —all phase angles at frequency of test)	Ψ	—	—	5:1	—

All published data at T_{CASE} = 25°C unless otherwise indicated.

ERICSSON

Electrical Characteristics (100% Tested)

Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 25 mA	$V_{(BR)DSS}$	65	—	—	Volts
Drain-Source Leakage Current	V_{DS} = 32 V, V_{GS} = 0 V	I_{DSS}	—	—	1.0	mA
Gate Threshold Voltage	V_{DS} = 10 V, I_D = 75 mA	$V_{GS(th)}$	3.0	—	5.0	Volts
Forward Transconductance	V_{DS} = 10 V, I_D = 3 A	g_{fs}	—	2.8	—	Siemens

Maximum Ratings

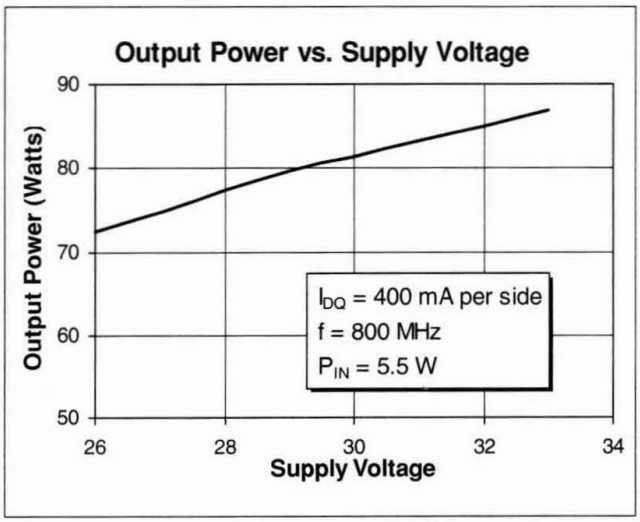
Parameter	Symbol	Value	Unit
Drain-Source Voltage(1)	V_{DSS}	65	Vdc
Gate-Source Voltage(1)	V_{GS}	±20	Vdc
Operating Junction Temperature	T_J	200	°C
Total Device Dissipation at Above 25°C derate by	P_D	225 2.0	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{CASE} = 70°C)	$R_{\theta JC}$	0.5	°C/W

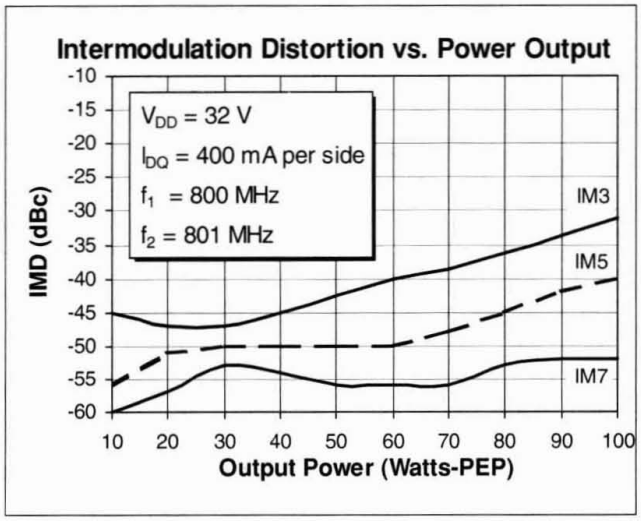
(1) per side

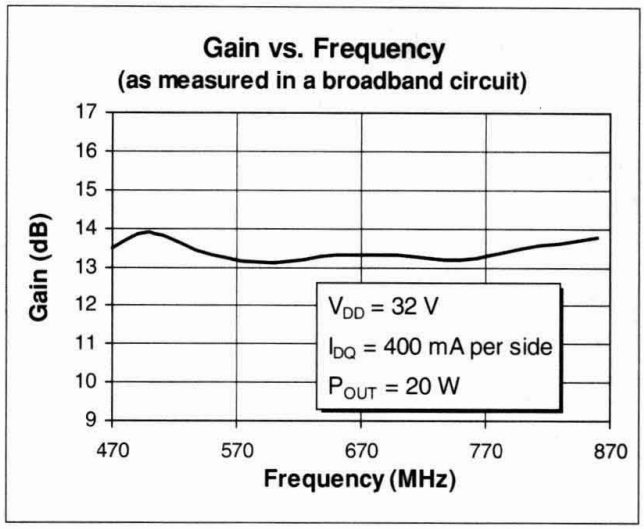
GOLDMOS™

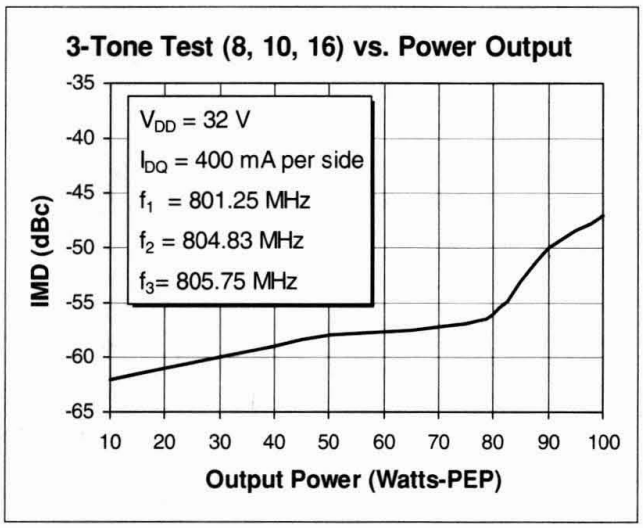
3

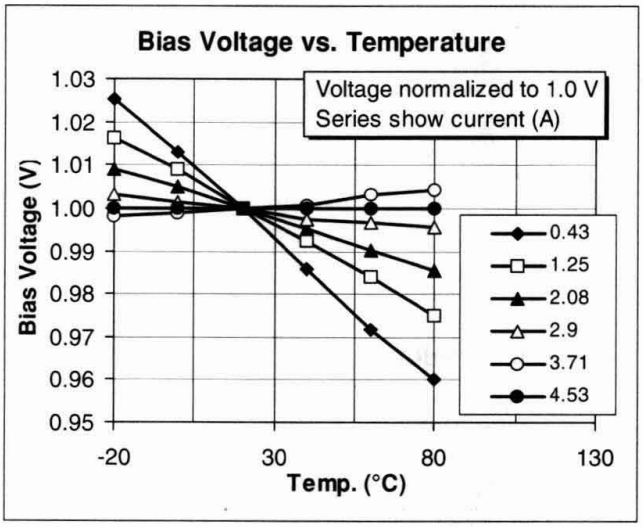
Typical Performance





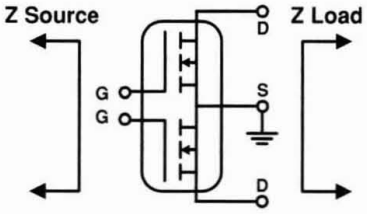

Gain vs. Frequency
(as measured in a broadband circuit)
Gain (dB)
17
16
15
14
13
12
11
10
9
470
570
670
770
870
Frequency (MHz)
V_{DD} = 32 V
I_{DQ} = 400 mA per side
P_{OUT} = 20 W


3-Tone Test (8, 10, 16) vs. Power Output
IMD (dBc)
-35
-40
-45
-50
-55
-60
-65
10
20
30
40
50
60
70
80
90
100
Output Power (Watts-PEP)
V_{DD} = 32 V
I_{DQ} = 400 mA per side
f_1 = 801.25 MHz
f_2 = 804.83 MHz
f_3= 805.75 MHz


Bias Voltage vs. Temperature
Bias Voltage (V)
1.03
1.02
1.01
1.00
0.99
0.98
0.97
0.96
0.95
-20
30
80
130
Temp. (°C)
Voltage normalized to 1.0 V
Series show current (A)
0.43
1.25
2.08
2.9
3.71
4.53

Impedance Data (shown for fixed-tuned broadband circuit)

V_{DD} = 32 V, P_{OUT} = 85 W, I_{DQ} = 400 mA per side



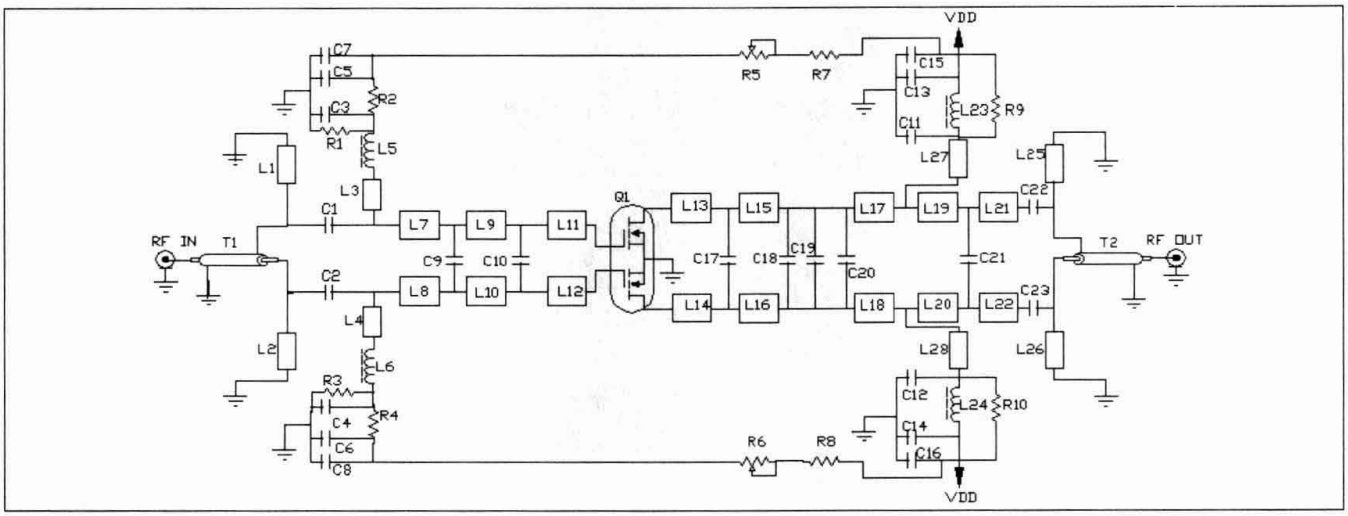
Frequency	Z Source Ω		Z Load Ω	
MHz	R	jX	R	jX
470	2.41	–4.23	8.02	–0.15
500	3.08	–5.08	6.70	–0.84
550	3.88	–5.08	8.42	+1.68
600	5.16	–6.82	7.77	+1.29
650	6.38	–9.00	7.83	+0.48
700	9.85	–12.17	4.82	+0.53
750	13.00	–7.00	4.48	–0.60
800	12.87	+0.00	3.97	–1.79
860	9.33	+5.13	2.75	–3.00

Typical Scattering Parameters (one side)

(V_{DS} = 32 V, I_D = 2 A)

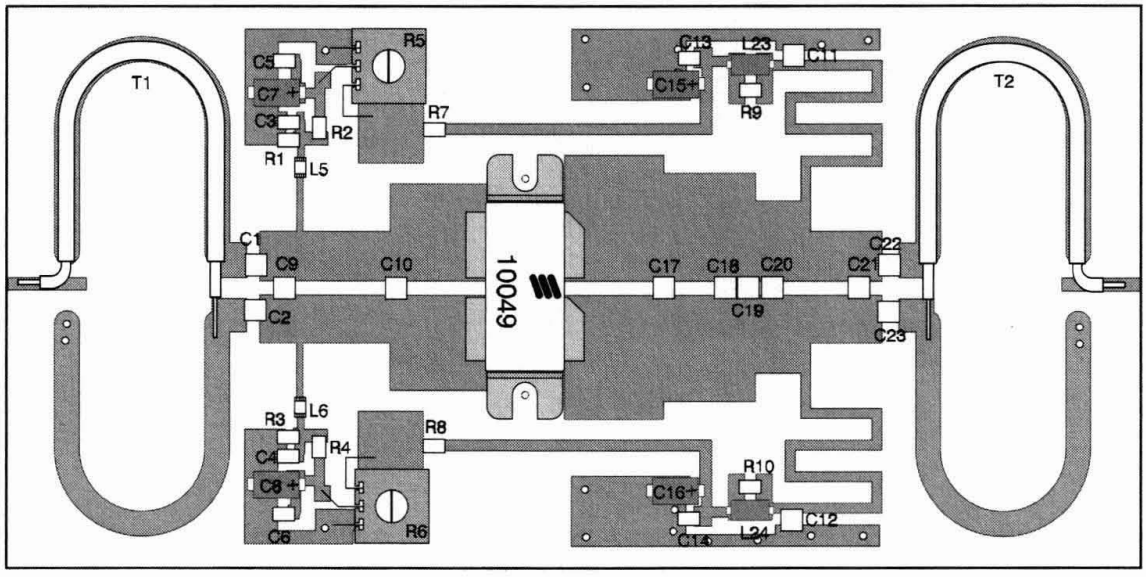
f	S11		S21		S12		S22	
(MHz)	Mag	Ang	Mag	Ang	Mag	Ang	Mag	Ang
400	0.94	176	2.04	9	0.004	–57	0.90	–163
425	0.94	175	1.94	6	0.004	–55	0.90	–164
450	0.94	174	1.86	3	0.004	–57	0.91	–165
475	0.94	173	1.81	0	0.003	–59	0.92	–167
500	0.93	172	1.78	–2	0.003	–59	0.92	–168
525	0.92	171	1.78	–6	0.003	–54	0.93	–169
550	0.91	169	1.80	–10	0.003	–51	0.93	–170
575	0.90	168	1.84	–14	0.003	–49	0.94	–171
600	0.86	166	1.92	–19	0.002	–54	0.94	–172
625	0.85	164	2.04	–25	0.003	–42	0.94	–173
650	0.80	162	2.20	–32	0.003	–43	0.94	–174
675	0.73	160	2.42	–44	0.003	–45	0.95	–176
700	0.63	161	2.64	–57	0.003	–63	0.96	–177
725	0.54	170	2.76	–75	0.003	–65	0.96	–178
750	0.55	–174	2.60	–98	0.003	–69	0.96	–179
775	0.67	–167	2.20	–117	0.002	–101	0.96	180
800	0.78	–168	1.77	–132	0.001	–110	0.96	179
825	0.86	–171	1.35	–144	0.001	–142	0.96	178
850	0.90	–174	1.06	–152	0.001	–137	0.96	177
875	0.93	–177	0.86	–157	0.001	145	0.96	176
900	0.95	–179	0.69	–163	0.001	108	0.96	175
925	0.96	179	0.58	–166	0.001	128	0.96	175
950	0.97	178	0.49	–169	0.001	99	0.96	174
975	0.97	177	0.41	–172	0.001	90	0.96	173
1000	0.97	176	0.36	–175	0.002	84	0.97	172

Test Circuit

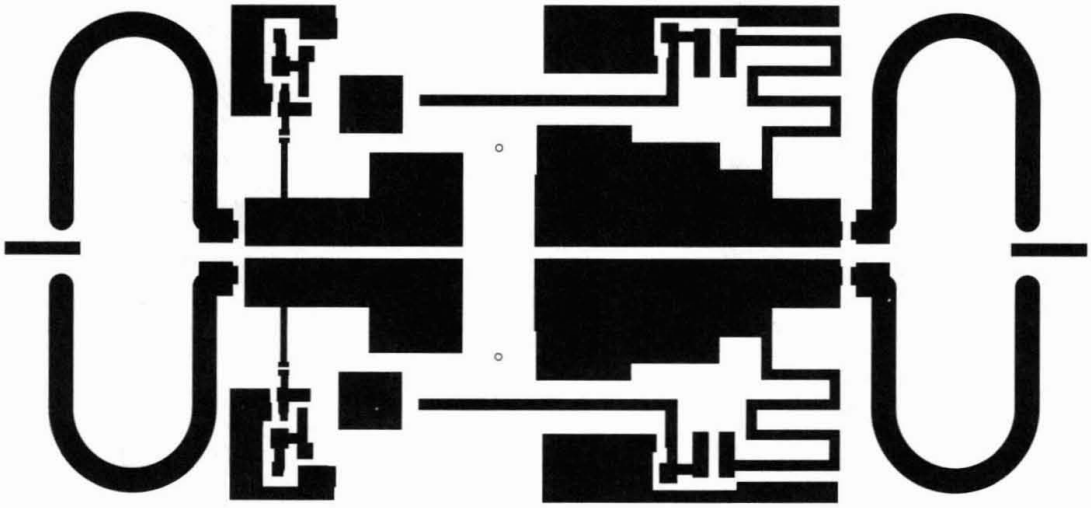


Block diagram for f = 470–806 MHz broadband circuit

Q1	PTF 10049	
L1, L2, L25, L26	0.25 λ 680 MHz	Microstrip 25 Ω
L3, L4	0.065 λ 800 MHz	Microstrip 70 Ω
L5, L6	10 nH	SMT Coil
L7, L8	0.010 λ 800 MHz	Microstrip 18.5 Ω
L9, L10	0.07 λ 800 MHz	Microstrip 18.5 Ω
L11, L12	0.060 λ 800 MHz	Microstrip 10.2 Ω
L13, L14	0.0525 λ 800 MHz	Microstrip 8.1 Ω
L15, L16	0.061 λ 800 MHz	Microstrip 9.3 Ω
L17, L18	0.032 λ 800 MHz	Microstrip 12.13 Ω
L19, L20	0.021 λ 800 MHz	Microstrip 22.6 Ω
L21, L22	0.01 λ 800 MHz	Microstrip 22.6 Ω
L23, L24	4x8 mm	Ferrite Bead
L27, L28	0.25 λ 680 MHz	Microstrip 60 Ω
C1, C2, C22, C23	51 pF	Chip Cap ATC 100 B
C3, C4, C11, C12	91 pF	Chip Cap ATC 100 B
C5, C6, C13, C14	0.1 µF	SMT K1206
C7, C8, C15, C16	10 µF	Electrolytic Capacitor
C9, C17	5.6 pF	Chip Cap ATC 100 B
C18	1.3 pF	Chip Cap ATC 100 B
C19, C20	1.7 pF	Chip Cap ATC 100 B
C10, C21	7.5 pF	Chip Cap ATC 100 B
R1, R3	200 Ω	K 1206 SMT Resistor
R2, R4	200 Ω	K 1206 SMT Resistor
R5, R6	1K Ω Pot	
R7, R8	500 Ω	1/4 W Resistor
R9, R10	1.8 Ω	1/4 W Resistor
T1, T2	UT-85-25 Balun Coaxial	
Circuit Board	.028" Dielectric Thickness, ε_r = 4.0, AlliedSignal, G200, 2 oz. copper	



Placement Diagram



Artwork (1 inch ———)

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Specifications subject to change without notice.
LF
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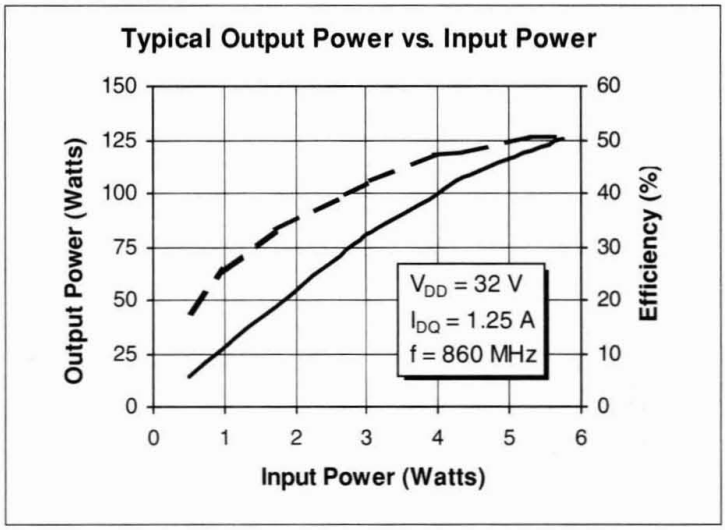
EUS/KR 1301-PTF 10049 Uen Rev. A 01-10-2000

PTF 10159
120 Watts, 470–860 MHz
GOLDMOS™ Field Effect Transistor

Description

The PTF 10159 is an internally matched, LDMOS FET intended for large signal television amplifier applications from 470 to 860 MHz. It is rated at 130 watts power output. Nitride surface passivation and full gold metallization ensure excellent device lifetime and reliability.

- ***INTERNALLY MATCHED***
- **Performance at 860 MHz, 32 Volts**
  - **Output Power = 130 Watts Typ**
  - **Power Gain = 14.0 dB Typ**
  - **Efficiency = 50% Typ**
- **Performance at 860 MHz, 28 Volts**
  - **Output Power = 100 Watts**
  - **Power Gain = 14.0 dB Typ**
  - **Efficiency = 50% Typ**
- **Full Gold Metallization**
- **Silicon Nitride Passivated**
- **Back Side Common Source**
- **100% Lot Traceability**



Package 20240

RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{DD} = 32 V, P_{OUT} = 120 W, I_{DQ} = 1.3 A Total, f = 860 MHz)	G_{ps}	12.0	14.0	—	dB
Drain Efficiency (V_{DD} = 32 V, P_{OUT} = 120 W, I_{DQ} = 1.3 A Total, f = 860 MHz)	η	45	50	—	%
Power Output at 1 dB Compression (V_{DD} = 32 V, I_{DQ} = 1.3 A Total, f = 860 MHz)	P-1dB	115	130	—	Watts
Load Mismatch Tolerance (V_{DD} = 32 V, P_{OUT} = 120 W, I_{DQ} = 1.3 A Total, f = 860.0 MHz— all phase angles at frequency of test)	Ψ	—	—	5:1	—

All published data at T_{CASE} = 25°C unless otherwise indicated.

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Electrical Characteristics (100% Tested—characteristics, conditions and limits shown per side)

Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 5 mA	$V_{(BR)DSS}$	65	—	—	Volts
Drain-Source Leakage Current	V_{DS} = 28 V, V_{GS} = 0 V	I_{DSS}	—	—	1.0	mA
Gate Threshold Voltage	V_{DS} = 10 V, I_D = 75 mA	$V_{GS(th)}$	3.0	—	5.0	Volts
Forward Transconductance	V_{DS} = 10 V, I_D = 3 A	g_{fs}	—	2.5	—	Siemens

Maximum Ratings

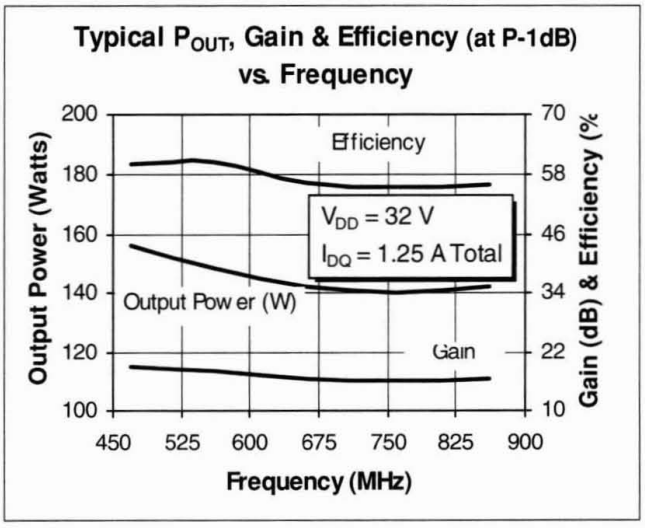
Parameter	Symbol	Value	Unit
Drain-Source Voltage[1]	V_{DSS}	65	Vdc
Gate-Source Voltage[1]	V_{GS}	±20	Vdc
Operating Junction Temperature	T_J	200	°C
Total Device Dissipation at Above 25°C derate by	P_D	290 1.67	Watts W/°C
Storage Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{CASE} = 70°C)	$R_{\theta JC}$	0.6	°C/W

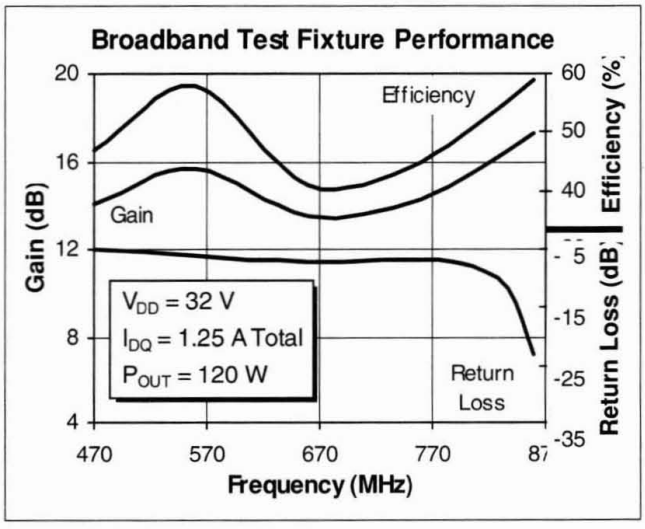
[1] per side

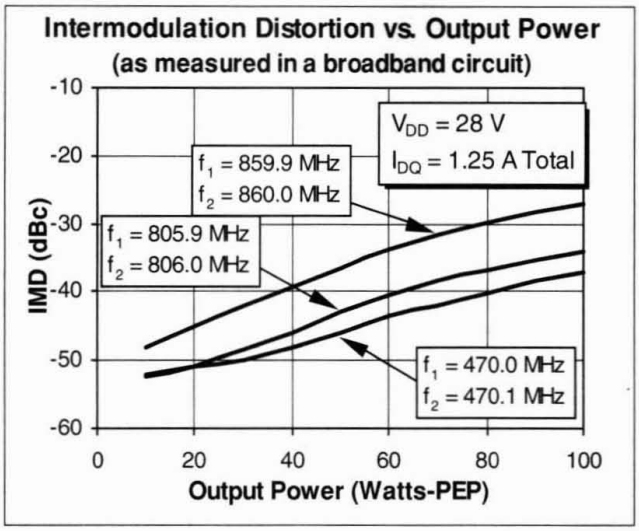
GOLDMOS™

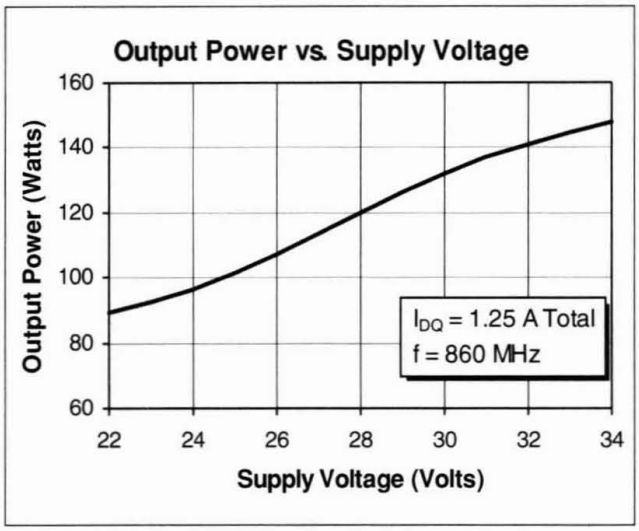
3

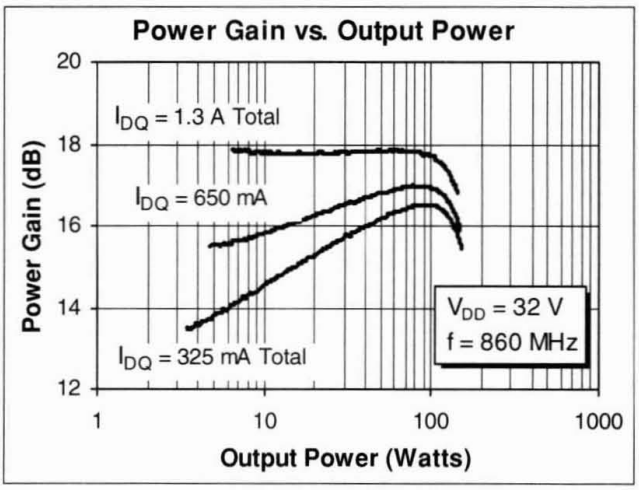
Typical Performance

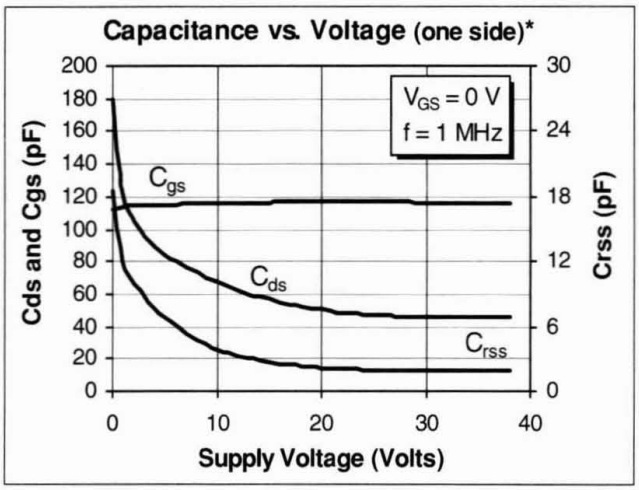




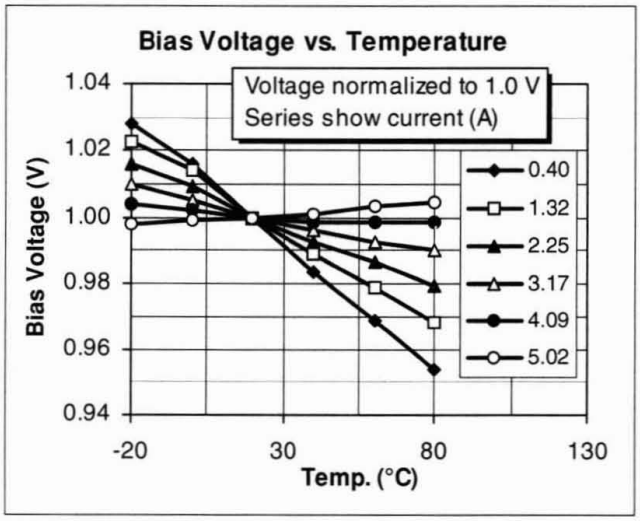






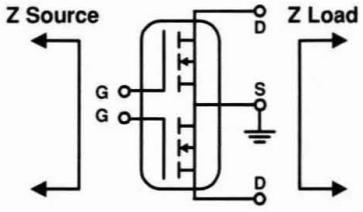


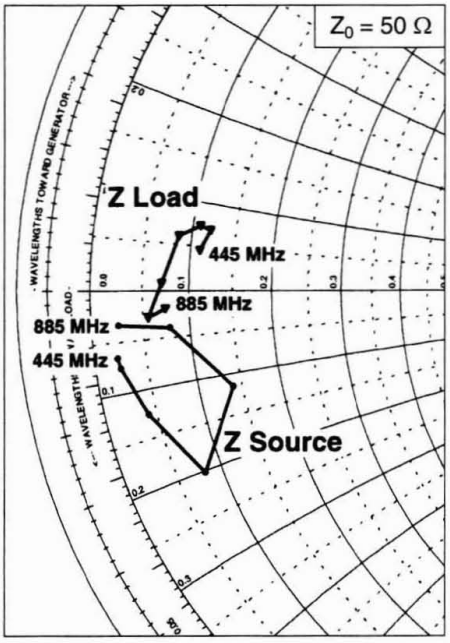
*This part is internally matched. Measurements of the finished product will not yield these figures.



Impedance Data

V_{DD} = 32 V, P_{OUT} = 120 W, I_{DQ} = 1.3 A Total





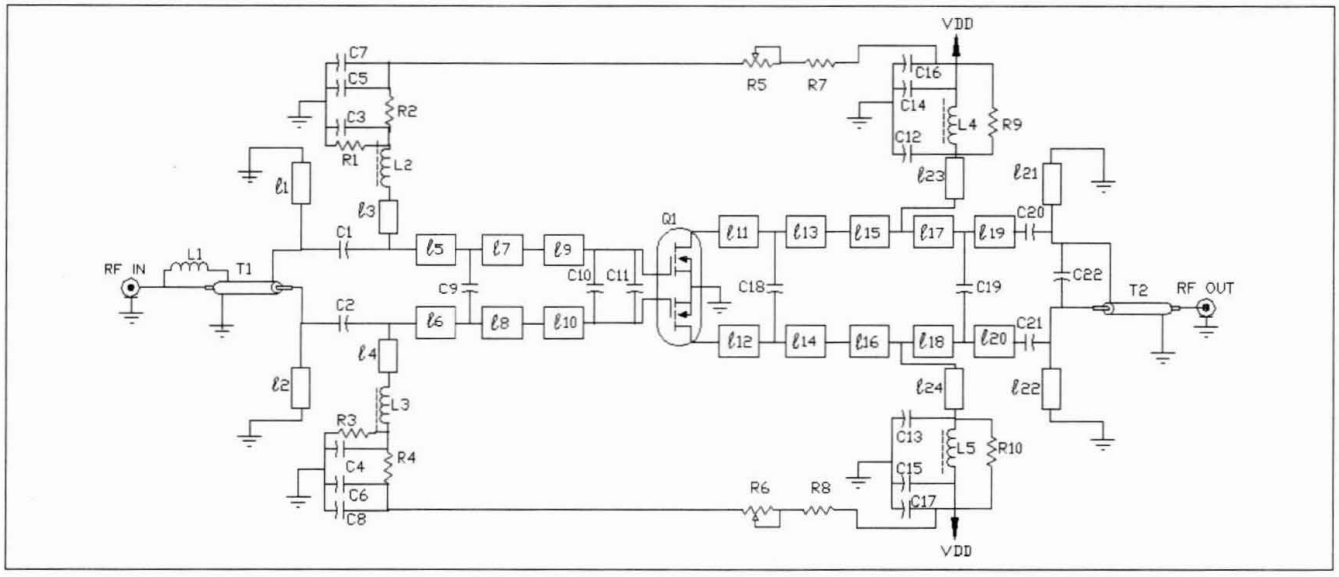
Frequency	Z Source Ω		Z Load Ω	
MHz	R	jX	R	jX
445	1.1	-3.3	5.5	2.3
470	1.2	-3.8	6.0	3.5
560	2.1	-6.3	5.4	3.7
660	4.0	-10.1	4.3	3.0
760	7.0	-5.8	3.5	0.4
860	3.9	-2.0	2.8	-1.4
885	1.3	-1.7	3.7	-1.0

Typical Scattering Parameters (one side)

(V_{DS} = 28 V, I_D = 4 A)

f	S11		S21		S12		S22	
(MHz)	Mag	Ang	Mag	Ang	Mag	Ang	Mag	Ang
400	0.966	179	1.56	14	0.003	-46.5	0.919	-165
410	0.965	178	1.54	12.7	0.003	-47.5	0.922	-165
420	0.964	178	1.51	11.5	0.003	-49.2	0.925	-165
430	0.964	178	1.49	10.3	0.003	-50.4	0.929	-166
440	0.963	178	1.46	9	0.003	-50.8	0.933	-166
450	0.962	178	1.45	7.7	0.003	-49.9	0.937	-166
460	0.961	177	1.43	6.6	0.003	-51.7	0.941	-166
470	0.958	177	1.42	5.4	0.003	-50.9	0.944	-167
480	0.956	177	1.41	4.3	0.003	-51.4	0.946	-167
490	0.955	177	1.41	3.1	0.003	-52.8	0.948	-167
500	0.953	176	1.41	1.8	0.003	-54.9	0.951	-167
510	0.951	176	1.41	0.5	0.003	-53.1	0.955	-167
520	0.949	176	1.42	-1	0.003	-56.5	0.957	-167
530	0.947	176	1.43	-2.6	0.003	-55.8	0.959	-168
540	0.944	175	1.44	-4.2	0.003	-53.3	0.961	-168
550	0.942	175	1.46	-6	0.003	-57.1	0.963	-168
560	0.936	175	1.48	-8	0.003	-58.2	0.966	-168
570	0.931	174	1.50	-10	0.003	-59.6	0.967	-169
580	0.926	174	1.52	-12.2	0.003	-61.1	0.969	-169
590	0.918	174	1.55	-14.4	0.003	-64.9	0.973	-169
600	0.911	174	1.59	-16.7	0.003	-67.7	0.977	-169
610	0.904	173	1.63	-19.3	0.003	-74.1	0.98	-169
620	0.893	173	1.68	-22.2	0.003	-74	0.985	-170
630	0.882	173	1.74	-25.6	0.003	-78.8	0.986	-170
640	0.869	173	1.81	-29.4	0.003	-83.7	0.991	-170
650	0.854	173	1.88	-33.9	0.003	-87.4	0.993	-171
660	0.836	173	1.95	-38.9	0.004	-94.1	0.996	-171
670	0.817	173	2.02	-44.5	0.004	-101	0.997	-171
680	0.798	174	2.08	-51	0.004	-109	0.998	-172
690	0.781	175	2.12	-58.1	0.004	-116	0.998	-172
700	0.768	177	2.14	-66.1	0.004	-125	0.998	-173
710	0.764	179	2.11	-74.3	0.004	-135	0.995	-173
720	0.769	-179	2.05	-82.6	0.004	-146	0.991	-174
730	0.783	-177	1.95	-90.6	0.004	-156	0.986	-174
740	0.804	-175	1.83	-98.2	0.004	-165	0.98	-174
750	0.828	-175	1.69	-105	0.004	-173	0.975	-174
760	0.851	-174	1.55	-112	0.004	175	0.97	-174
770	0.871	-174	1.41	-117	0.004	169	0.967	-174
780	0.889	-174	1.29	-122	0.003	160	0.964	-174
790	0.906	-175	1.17	-127	0.003	155	0.963	-174
800	0.919	-175	1.06	-131	0.003	147	0.96	-174
810	0.93	-176	0.966	-134	0.003	142	0.96	-174
820	0.94	-176	0.88	-137	0.003	138	0.959	-174
830	0.948	-177	0.804	-140	0.003	135	0.958	-174
840	0.953	-177	0.734	-143	0.003	130	0.958	-174
850	0.96	-177	0.672	-145	0.003	127	0.958	-174
860	0.963	-178	0.616	-147	0.003	123	0.958	-174
870	0.966	-178	0.566	-148	0.003	120	0.958	-174
880	0.97	-179	0.523	-150	0.003	121	0.96	-174
890	0.972	-179	0.485	-151	0.003	116	0.961	-174
900	0.973	-179	0.452	-152	0.003	118	0.962	-174
910	0.976	-180	0.421	-154	0.003	114	0.962	-175
920	0.978	-180	0.394	-155	0.003	110	0.963	-175
930	0.979	180	0.368	-156	0.003	108	0.961	-175
940	0.982	180	0.346	-157	0.003	108	0.962	-175
950	0.983	179	0.325	-158	0.003	106	0.962	-175
960	0.983	179	0.305	-159	0.003	107	0.961	-175
970	0.985	179	0.287	-160	0.003	105	0.963	-175
980	0.985	179	0.269	-161	0.003	106	0.964	-175
990	0.984	178	0.254	-162	0.003	107	0.964	-175
1000	0.987	178	0.239	-162	0.003	105	0.965	-175

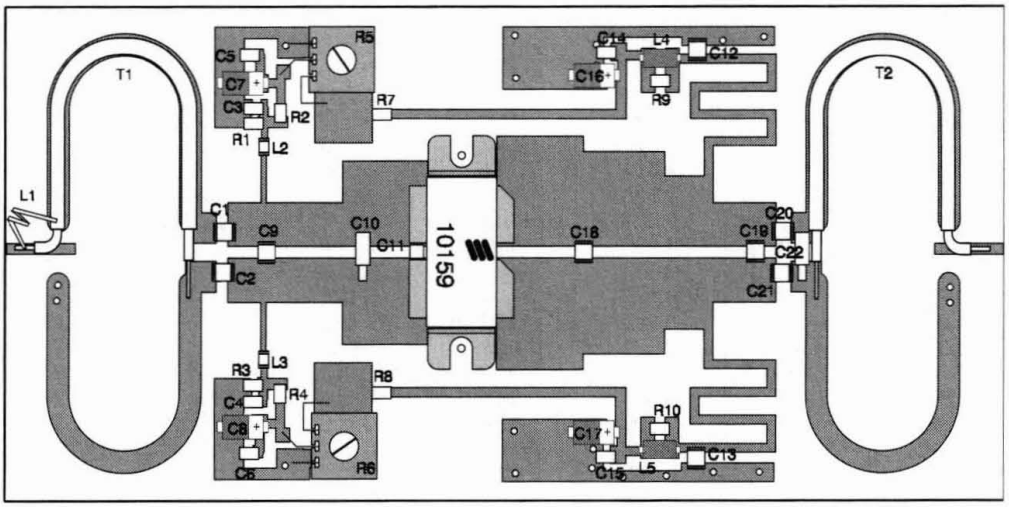
Test Circuit



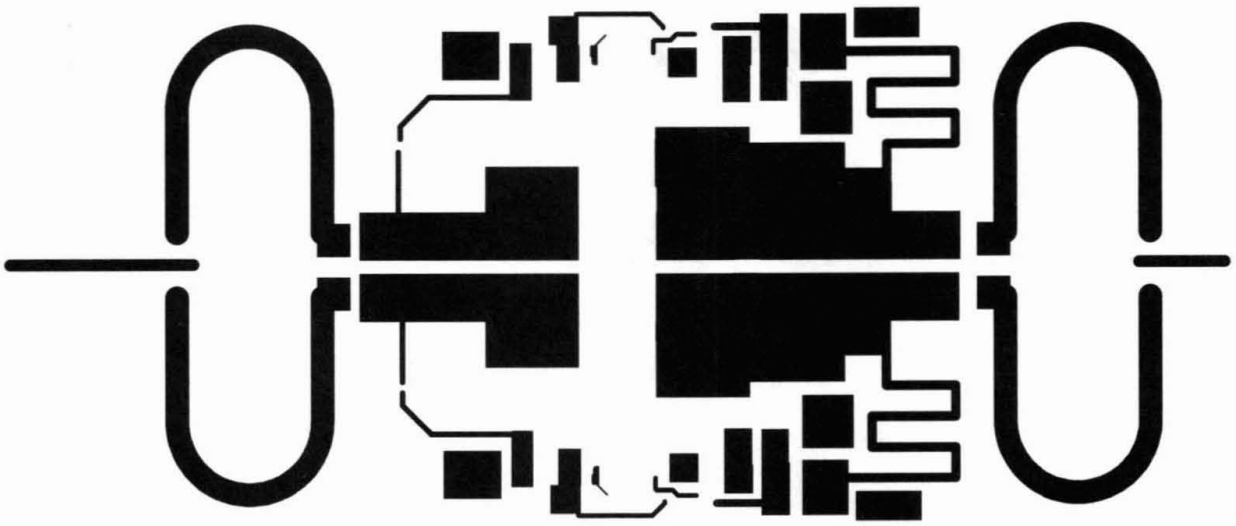
Block diagram for f = 470–860 MHz broadband circuit

Q1	PTF 10159	
L1	1 Turn, #22 AWG, 0.12" I.D.	
L2, L3	10 nH	SMT Coil
L4, L5	4x8 mm	Ferrite Bead
ℓ1, ℓ2, ℓ21, ℓ22	0.25 λ 680 MHz	Microstrip 25 Ω
ℓ3, ℓ4	0.065 λ 800 MHz	Microstrip 70 Ω
ℓ5, ℓ6	0.010 λ 800 MHz	Microstrip 18.5 Ω
ℓ7, ℓ8	0.07 λ 800 MHz	Microstrip 18.5 Ω
ℓ9, ℓ10	0.060 λ 800 MHz	Microstrip 10.2 Ω
ℓ11, ℓ12	0.0525 λ 800 MHz	Microstrip 8.1 Ω
ℓ13, ℓ14	0.061 λ 800 MHz	Microstrip 9.3 Ω
ℓ15, ℓ16	0.032 λ 800 MHz	Microstrip 12.13 Ω
ℓ17, ℓ18	0.021 λ 800 MHz	Microstrip 22.6 Ω
ℓ19, ℓ20	0.01 λ 800 MHz	Microstrip 22.6 Ω
ℓ23, ℓ24	0.25 λ 680 MHz	Microstrip 60 Ω
C1, C2, C20, C21	51 pF	Chip Cap ATC 100 B

C3, C4, C12, C13	91 pF	Chip Cap ATC 100 B
C5, C6, C14, C15	0.1 µF	SMT K1206
C7, C8, C16, C17	10 µF	Electrolytic Capacitor
C9	11 pF	Chip Cap ATC 100 B
C10, C22	0.6–6.0 pF	Variable Capacitor, Johanson Trimmer
C11	4.7 pF	Chip Cap ATC 100 A
C18	13.0 pF	Chip Cap ATC 100 B
C19	3.6 pF	Chip Cap ATC 100 B
R1, R3	200 Ω	1/8 W K 1206 SMT Resistor
R2, R4	200 Ω	1/8 W K 1206 SMT Resistor
R5, R6	1 K Ω	1/4 W Potentiometer
R7, R8	500 Ω	1/4 W Resistor
R9, R10	1.8 Ω	1/4 W Resistor
T1, T2	UT-85-25 Balun	Coaxial
Circuit Board	.028" Dielectric Thickness, ε_r = 4.0, AlliedSignal, G200, 2 oz. copper	



Components layout (not to scale)



Test circuit artwork (1 inch ——— *)*

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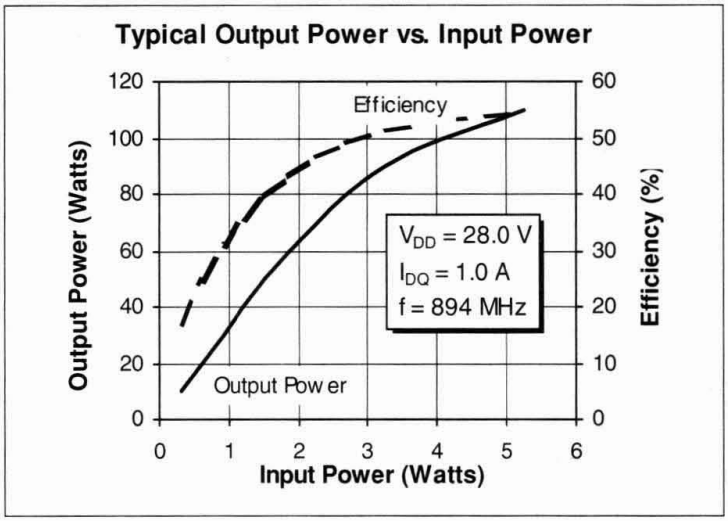
EUS/KR 1301-PTF 10159 Uen Rev. A 01-08-2000

PTF 10133
85 Watts, 860–960 MHz
GOLDMOS™ Field Effect Transistor

Description

The PTF 10133 is an internally matched 85 watt LDMOS FET intended for cellular, GSM and D-AMPS applications. This device operates at 50% efficiency with 13.5 dB of gain. Full gold metallization ensures excellent device lifetime and reliability.

- ***INTERNALLY MATCHED***
- **Performance at 894 MHz, 28 Volts**
  - **Output Power = 85 Watts**
  - **Power Gain = 13.5 dB Typ**
  - **Efficiency = 50% Typ**
- **Full Gold Metallization**
- **Silicon Nitride Passivated**
- **Excellent Thermal Stability**
- **100% Lot Traceability**



Package 20248

RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{DD} = 28 V, P_{OUT} = 85 W, I_{DQ} = 1.0 A, f = 894 MHz)	G_{ps}	12.5	13.5	—	dB
Power Output at 1 dB Compression (V_{DD} = 28 V, I_{DQ} = 1.0 A, f = 894 MHz)	P-1dB	85	90	—	Watts
Drain Efficiency (V_{DD} = 28 V, P_{OUT} = 85 W, I_{DQ} = 1.0 A, f = 894 MHz)	η	45	50	—	%
Load Mismatch Tolerance (V_{DD} = 28 V, P_{OUT} = 85 W, I_{DQ} = 1.0 A, f = 894 MHz —all phase angles at frequency of test)	Ψ	—	—	10:1	—

All published data at T_{CASE} = 25°C unless otherwise indicated.

ERICSSON

Electrical Characteristics (100% Tested)

Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 25 mA	$V_{(BR)DSS}$	65	—	—	Volts
Drain-Source Leakage Current	V_{DS} = 28 V, V_{GS} = 0 V	I_{DSS}	—	—	1.0	mA
Gate Threshold Voltage	V_{DS} = 10 V, I_D = 75 mA	$V_{GS(th)}$	3.0	—	5.0	Volts
Forward Transconductance	V_{DS} = 10 V, I_D = 3 A	g_{fs}	—	3.0	—	Siemens

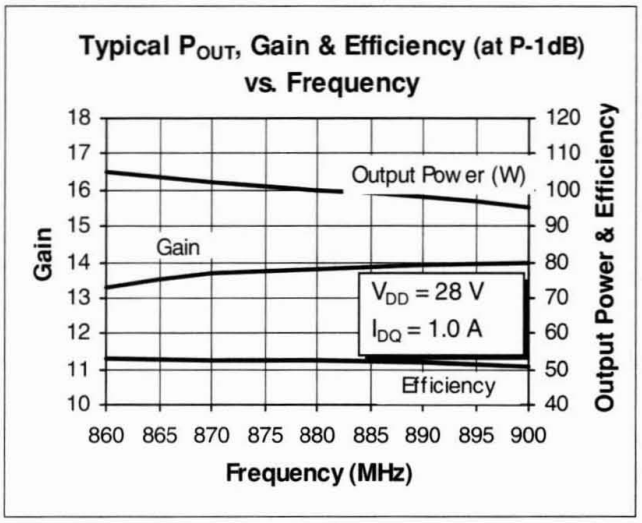
Maximum Ratings

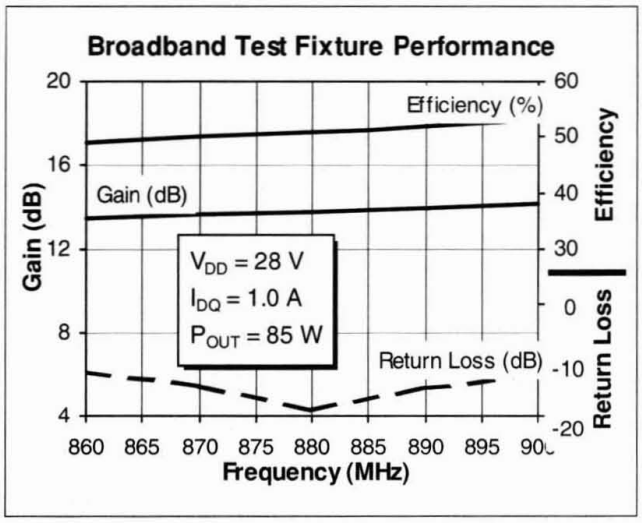
Parameter	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	65	Vdc
Gate-Source Voltage	V_{GS}	±20	Vdc
Operating Junction Temperature	T_J	200	°C
Total Device Dissipation Above 25°C derate by	P_D	205 1.18	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{CASE} = 70°C)	$R_{\theta JC}$	0.85	°C/W

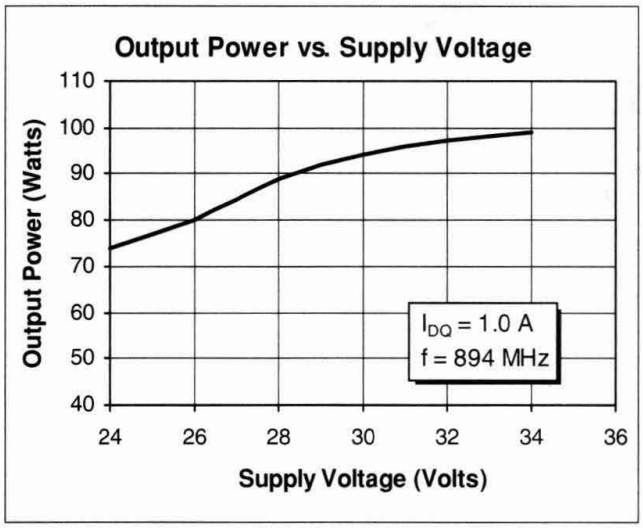
GOLDMOS™

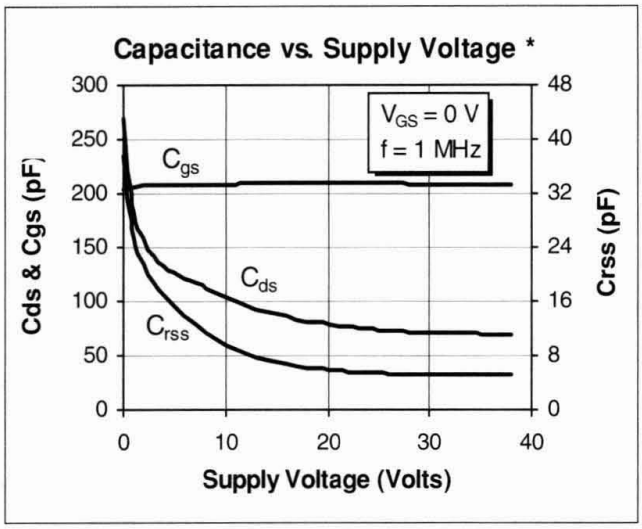
3

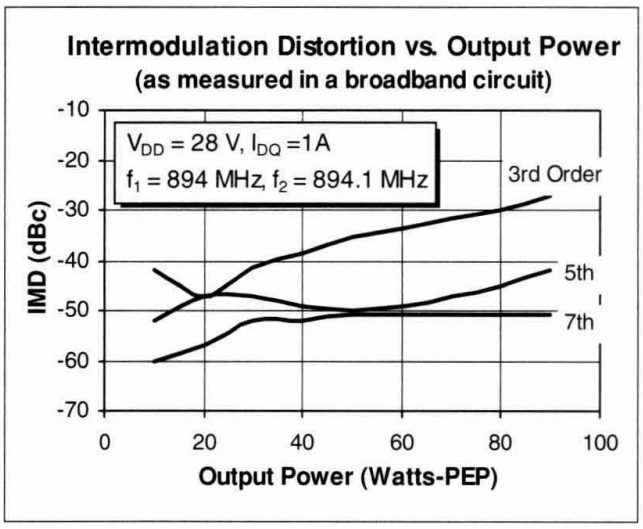
Typical Performance

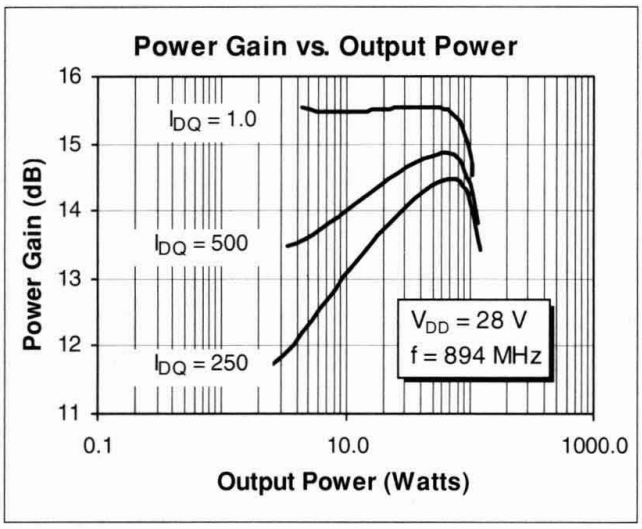




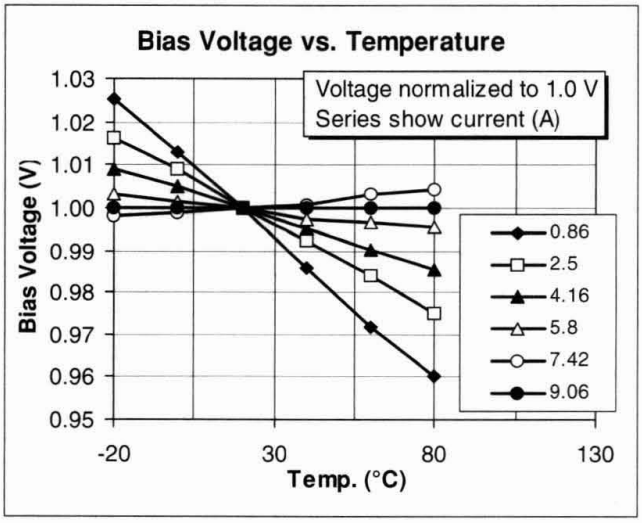






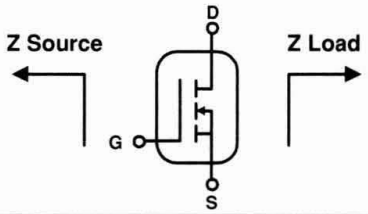


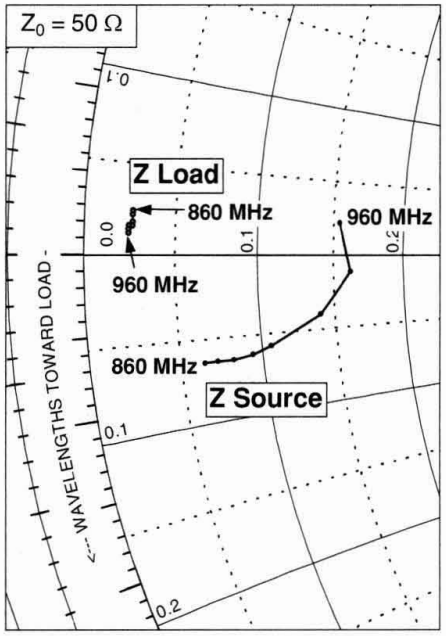
* This part is internally matched. Measurements of the finished product will not yield these figures.



Impedance Data

(V_{DD} = 28 V, P_{OUT} = 85 W, I_{DQ} = 1.0 A)





Frequency	Z Source Ω		Z Load Ω	
MHz	R	jX	R	jX
860	3.2	-3.2	1.3	1.2
870	3.6	-3.2	1.3	1.1
880	4.1	-3.2	1.3	0.9
890	4.7	-3.1	1.3	0.8
900	5.3	-2.9	1.2	0.8
925	7.0	-2.0	1.2	0.7
942	8.1	-0.6	1.2	0.7
960	7.7	1.1	1.2	0.6

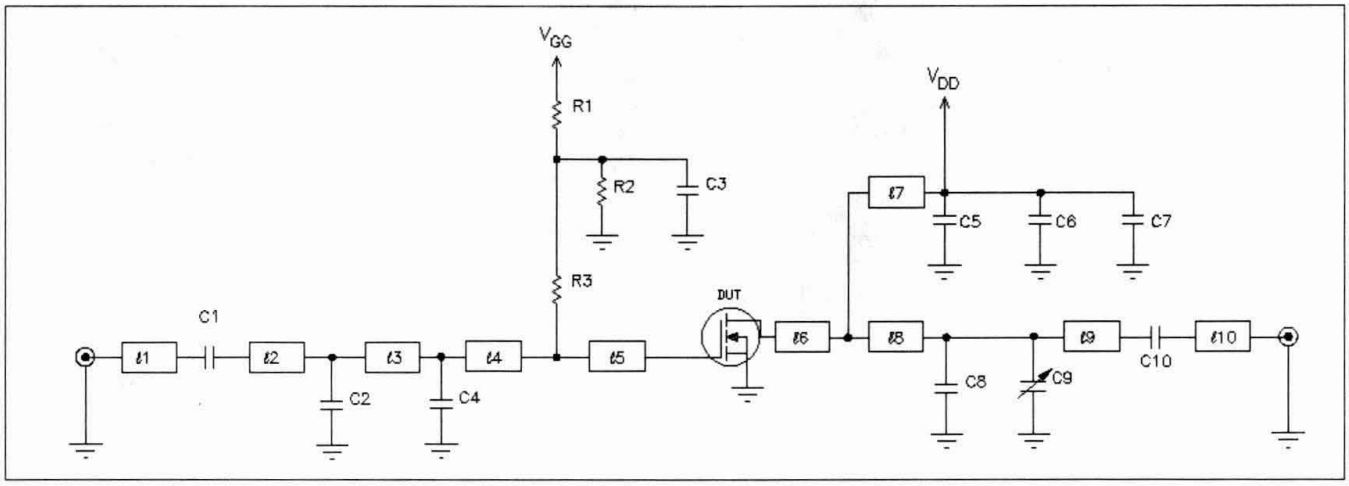
GOLDMOS™

Typical Scattering Parameters

(V_{DS} = 28 V, I_D = 2 A per side)

f	S11		S21		S12		S22	
(MHz)	Mag	Ang	Mag	Ang	Mag	Ang	Mag	Ang
300	0.980	-178	0.996	15.6	0.010	-85.2	0.994	-177
350	0.982	-179	0.773	12.8	0.008	-85.3	0.993	-177
400	0.983	-180	0.641	9.48	0.006	-85.7	0.992	-178
450	0.989	179	0.545	7.19	0.005	-85.3	0.996	-179
500	0.989	179	0.489	5.48	0.003	-93.7	0.999	-179
550	0.987	179	0.449	2.11	0.002	-74.5	0.995	-179
600	0.983	178	0.425	-0.90	0.002	-64.9	0.996	-179
650	0.982	177	0.414	-4.52	0.001	-68.5	0.998	-180
700	0.980	176	0.405	-10.2	0.001	-55.1	0.997	-180
750	0.972	175	0.419	-14.3	0.001	-88.5	0.997	180
800	0.958	174	0.442	-19.9	0.001	-87.2	0.993	180
850	0.929	171	0.509	-27.5	0.005	-105	0.991	179
900	0.858	168	0.662	-42.4	0.013	-133	0.989	179
950	0.693	173	0.882	-75.9	0.030	174	0.987	179
1000	0.783	-170	0.714	-125	0.028	120	0.993	179
1050	0.918	-172	0.423	-153	0.022	101	0.989	179
1100	0.951	-175	0.261	-167	0.020	89.2	0.982	179
1150	0.974	-177	0.184	-179	0.019	81.8	0.982	178
1200	0.988	-178	0.124	165	0.018	77.9	0.990	178
1250	0.984	-179	0.060	158	0.017	76.7	0.990	178
1300	0.979	-180	0.048	-154	0.018	77.4	0.986	178
1350	0.980	180	0.070	179	0.018	73.9	0.983	178
1400	0.992	180	0.058	166	0.018	74.5	0.990	177
1450	0.991	179	0.049	156	0.019	78.7	0.992	178
1500	0.986	178	0.042	149	0.021	79.7	0.984	178

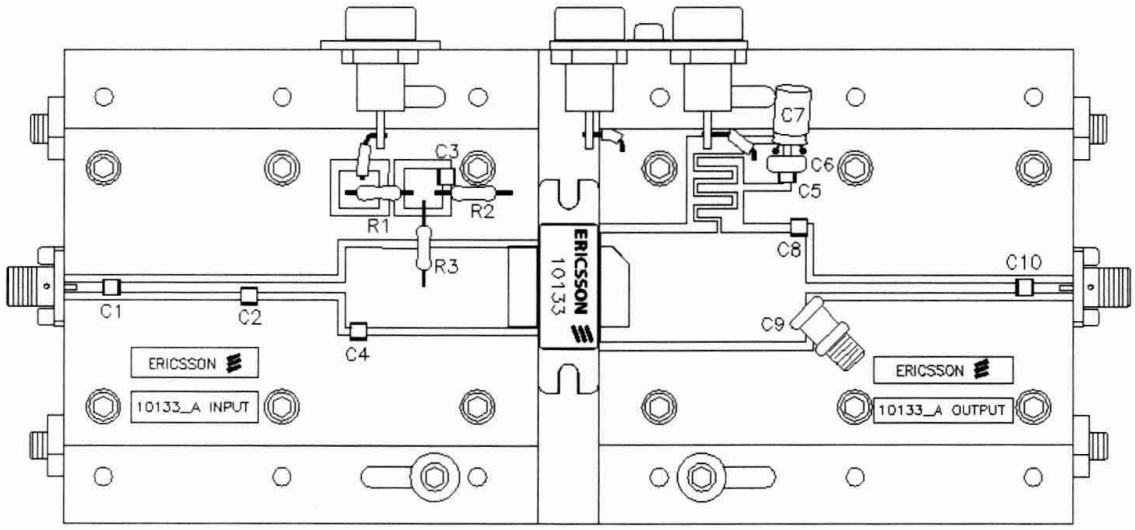
Test Circuit



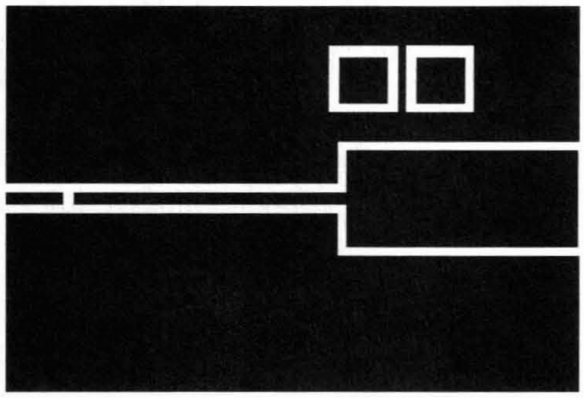
Test Circuit Schematic for f = 894 MHz

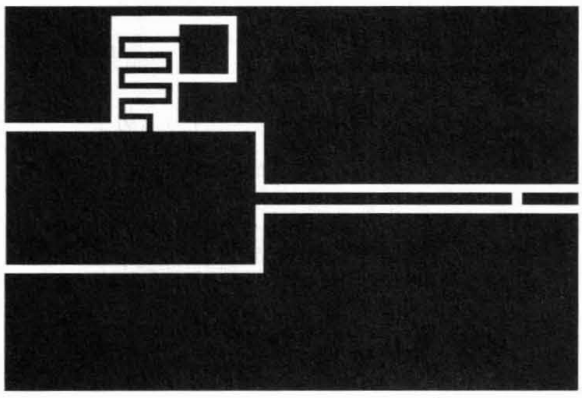
DUT	PTF 10133	LDMOS Field Effect Transistor
ℓ1	0.040 λ 894 GHz	Microstrip 50 Ω
ℓ2	0.096 λ 894 GHz	Microstrip 50 Ω
ℓ3	0.098 λ 894 GHz	Microstrip 50 Ω
ℓ4	0.073 λ 894 GHz	Microstrip 9.29 Ω
ℓ5	0.107 λ 894 GHz	Microstrip 9.29 Ω
ℓ6	0.110 λ 894 GHz	Microstrip 6.98 Ω
ℓ7	0.250 λ 894 GHz	Microstrip 77.9 Ω
ℓ8	0.081 λ 894 GHz	Microstrip 6.98 Ω
ℓ9	0.178 λ 894 GHz	Microstrip 50 Ω
ℓ10	0.040 λ 894 GHz	Microstrip 50 Ω

C1, C3, C5, C10	Capacitor, 36 pF	ATC 100 B
C2	Capacitor, 4.3 pF	ATC 100 B
C4	Capacitor, 6.2 pF	ATC 100 B
C6	Capacitor, 0.1 µF, 50 V	Digi-Key P4525-ND
C7	Capacitor, 100 µF, 50 V	Digi-Key P5182-ND
C8	Capacitor, 2.0 pF	ATC 100 B
C9	Capacitor, 0.6-6 pF	ATC 100 B
R1, R2, R3	Resistor, 220 Ω	Digi-Key 1KQBK
Circuit Board	ε_r = 4.0, .028 Dielectric Thickness, 1 Oz.	
Circuit Board	.028" Dielectric Thickness, ε_r = 4.0, AlliedSignal, G200, 2 oz. copper	



Components Layout (not to scale)





Artwork (1 inch ———)

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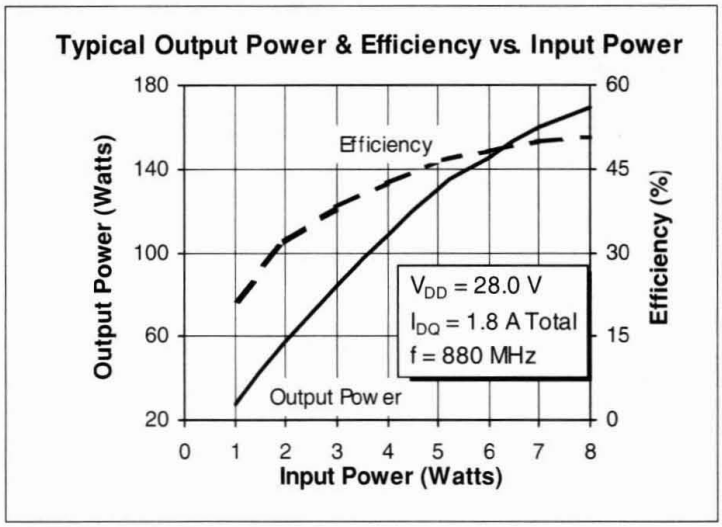
EUS/KR 1301-PTF 10133 Uen Rev. A 12-01-99

PTF 10100
165 Watts, 860–900 MHz
GOLDMOS™ Field Effect Transistor

Description

The PTF 10100 is an internally matched, 165 Watt LDMOS FET intended for large signal amplifier applications from 860 to 900 MHz. Nitride surface passivation and full gold metallization ensure excellent device lifetime and reliability.

- ***INTERNALLY MATCHED***
- **Performance at 894 MHz, 28 Volts**
  - **Output Power = 165 Watts**
  - **Power Gain = 13.0 dB Typ**
  - **Drain Efficiency = 50% Typ**
- **Full Gold Metallization**
- **Silicon Nitride Passivated**
- **Back Side Common Source**
- **100% lot traceability**



Package 20250

RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{DD} = 28 V, P_{OUT} = 165 W, I_{DQ} = 1.8 A Total, f = 894 MHz)	G_{ps}	12.0	13.0	—	dB
Power Output at 1 dB Compression (V_{DD} = 28 V, I_{CQ} = 1.8 A Total, f = 880 MHz)	P-1dB	165	180	—	Watts
Drain Efficiency (V_{DD} = 28 V, P_{OUT} = 165 W, I_{DQ} = 1.8 A Total, f = 894 MHz)	η	45	50	—	%
Load Mismatch Tolerance (V_{DD} = 28 V, P_{OUT} = 165 W(PEP), I_{DQ} = 1.8 A Total, f = 893.9, 894 MHz—all phase angles at frequency of test)	Ψ	—	—	10:1	—

All published data at T_{CASE} = 25°C unless otherwise indicated.

ERICSSON

Electrical Characteristics (per side) (100% Tested)

Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 5 mA	$V_{(BR)DSS}$	65	—	—	Volts
Drain-Source Leakage Current	V_{DS} = 28 V, V_{GS} = 0 V	I_{DSS}	—	—	1.0	mA
Gate Threshold Voltage	V_{DS} = 10 V, I_D = 75 mA	$V_{GS(th)}$	3.0	—	5.0	Volts
Forward Transconductance	V_{DS} = 10 V, I_D = 3 A	g_{fs}	—	2.5	—	Siemens

Maximum Ratings

Parameter	Symbol	Value	Unit
Drain-Source Voltage (1)	V_{DSS}	65	Vdc
Gate-Source Voltage (1)	V_{GS}	±20	Vdc
Operating Junction Temperature	T_J	200	°C
Total Device Dissipation at Above 25°C derate by	P_D	500 2.85	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{CASE} = 70°C)	$R_{\theta JC}$	0.35	°C/W

(1) per side

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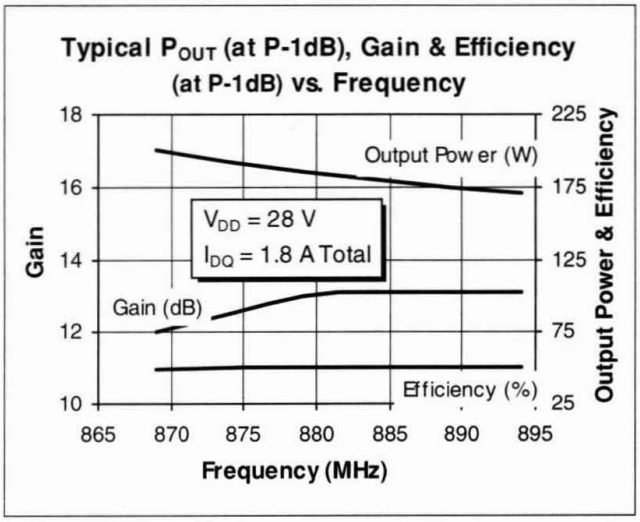
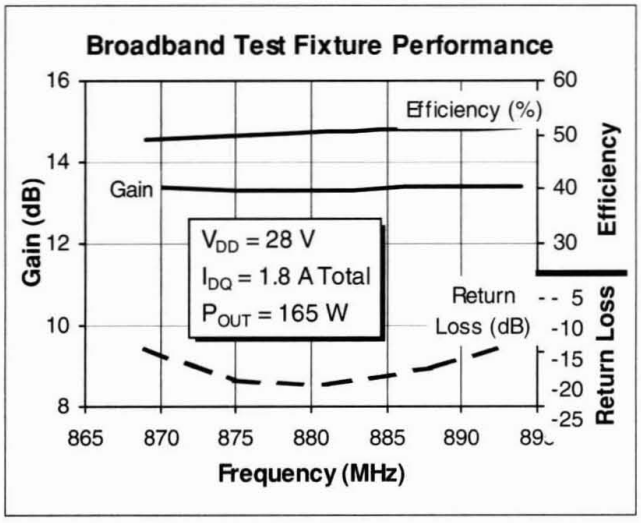
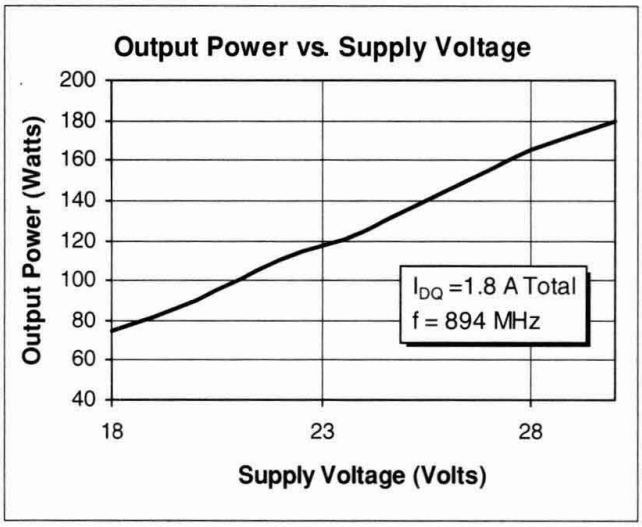
3

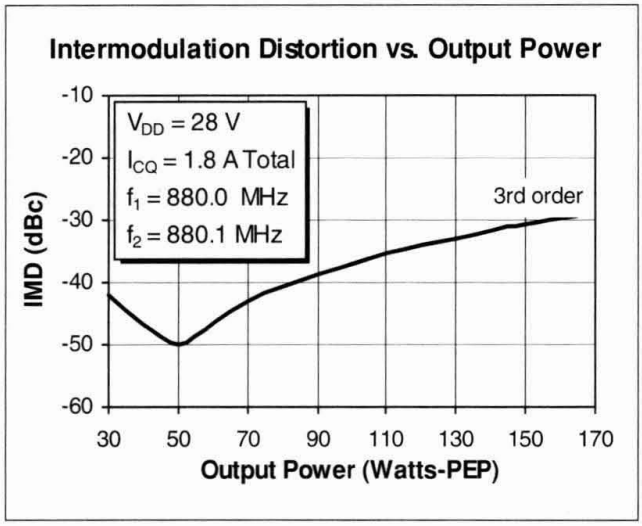
Typical Performance

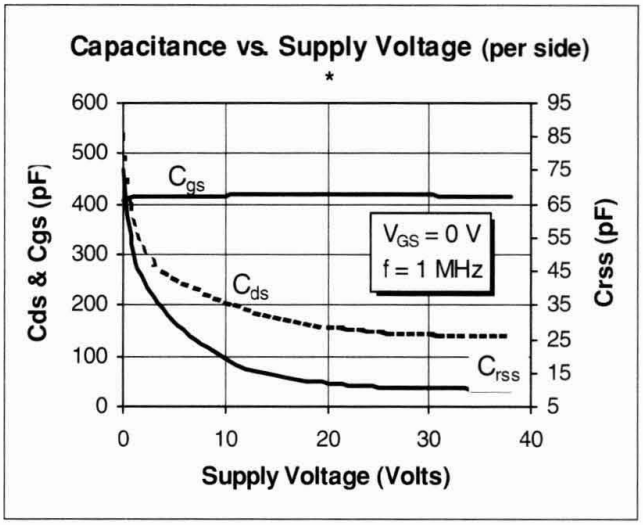


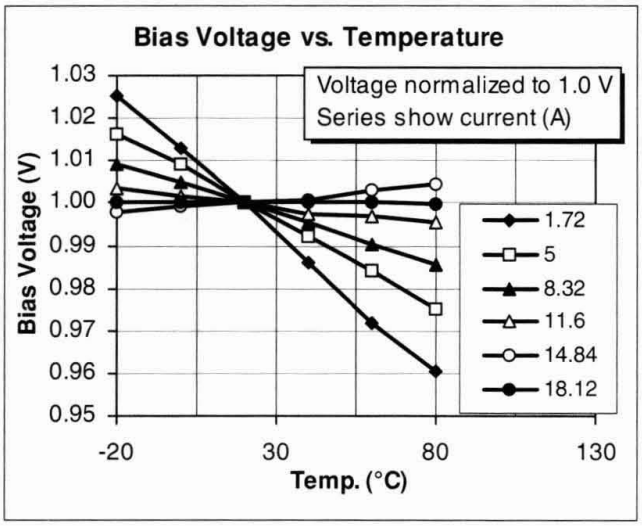


Typical Performance





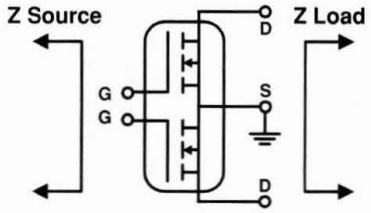


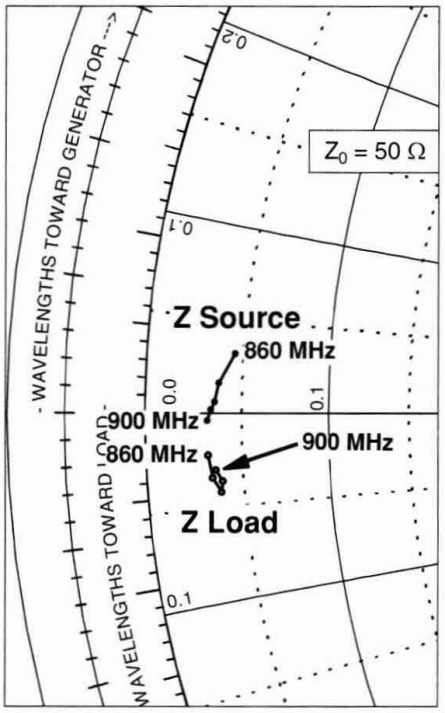


*This part is internally matched. Measurements of the finished product will not yield these figures.

Impedance Data

V_{DD} = 28 V, I_{DQ} = 1.8 A Total, P_{OUT} = 165 W





Frequency	Z Source Ω		Z Load Ω	
MHz	R	jX	R	jX
860	2.3	1.6	1.60	-1.1
870	1.9	0.8	1.70	-1.7
880	1.8	0.3	1.90	-2.1
890	1.7	0.1	1.95	-1.8
900	1.6	-0.2	1.80	-1.5

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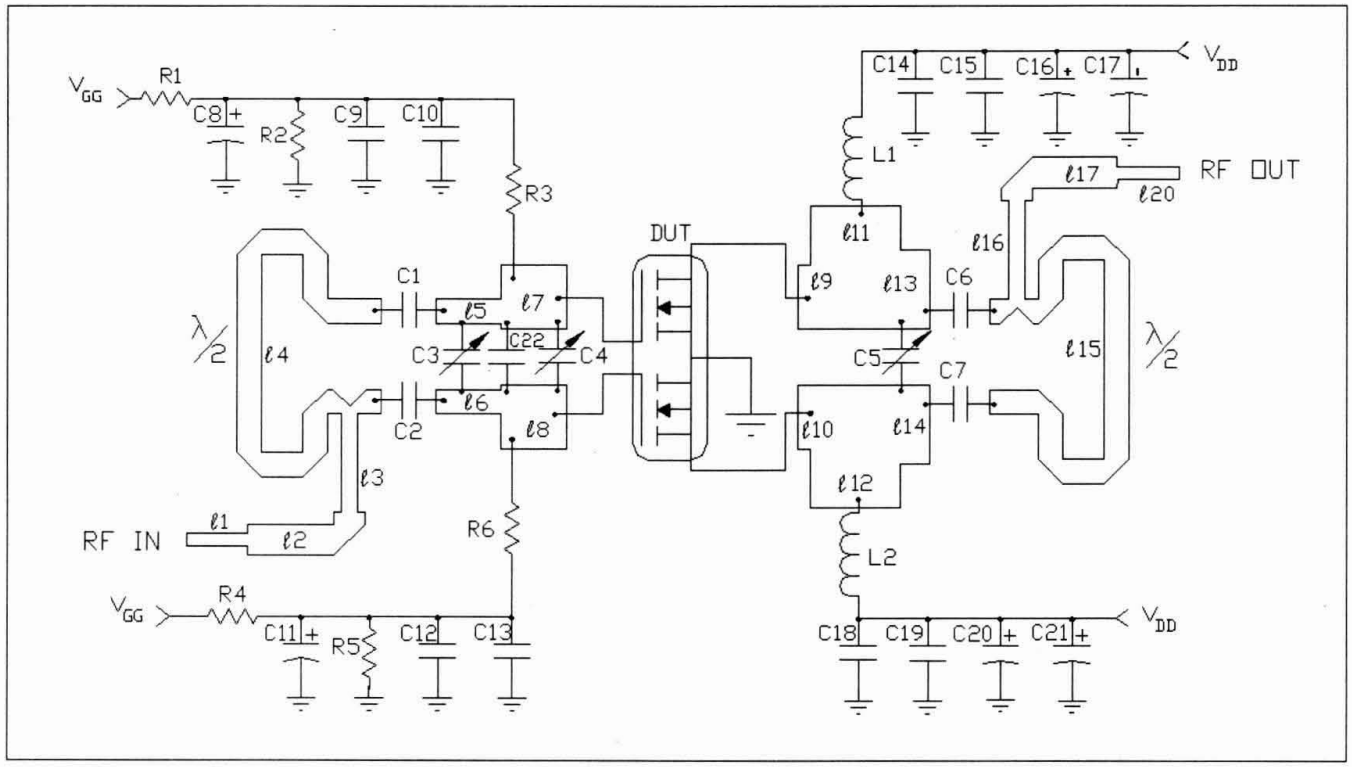
Typical Scattering Parameters

(V_{DS} = 28 V, I_D = 2 A per side)

f	S11		S21		S12		S22	
(MHz)	Mag	Ang	Mag	Ang	Mag	Ang	Mag	Ang
300	0.980	-178	0.996	15.6	0.010	-85.2	0.994	-177
350	0.982	-179	0.773	12.8	0.008	-85.3	0.993	-177
400	0.983	-180	0.641	9.48	0.006	-85.7	0.992	-178
450	0.989	179	0.545	7.19	0.005	-85.3	0.996	-179
500	0.989	179	0.489	5.48	0.003	-93.7	0.999	-179
550	0.987	179	0.449	2.11	0.002	-74.5	0.995	-179
600	0.983	178	0.425	-0.90	0.002	-64.9	0.996	-179
650	0.982	177	0.414	-4.52	0.001	-68.5	0.998	-180
700	0.980	176	0.405	-10.2	0.001	-55.1	0.997	-180
750	0.972	175	0.419	-14.3	0.001	-88.5	0.997	180
800	0.958	174	0.442	-19.9	0.001	-87.2	0.993	180
850	0.929	171	0.509	-27.5	0.005	-105	0.991	179
900	0.858	168	0.662	-42.4	0.013	-133	0.989	179
950	0.693	173	0.882	-75.9	0.030	174	0.987	179
1000	0.783	-170	0.714	-125	0.028	120	0.993	179
1050	0.918	-172	0.423	-153	0.022	101	0.989	179
1100	0.951	-175	0.261	-167	0.020	89.2	0.982	179
1150	0.974	-177	0.184	-179	0.019	81.8	0.982	178
1200	0.988	-178	0.124	165	0.018	77.9	0.990	178
1250	0.984	-179	0.060	158	0.017	76.7	0.990	178
1300	0.979	-180	0.048	-154	0.018	77.4	0.986	178
1350	0.980	180	0.070	179	0.018	73.9	0.983	178
1400	0.992	180	0.058	166	0.018	74.5	0.990	177
1450	0.991	179	0.049	156	0.019	78.7	0.992	178
1500	0.986	178	0.042	149	0.021	79.7	0.984	178

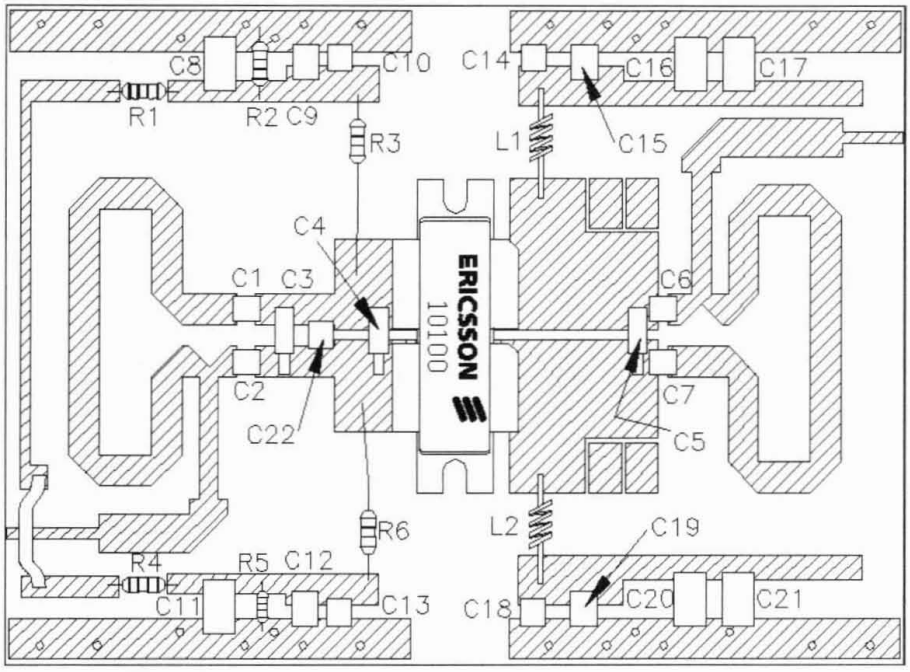
Test Circuit



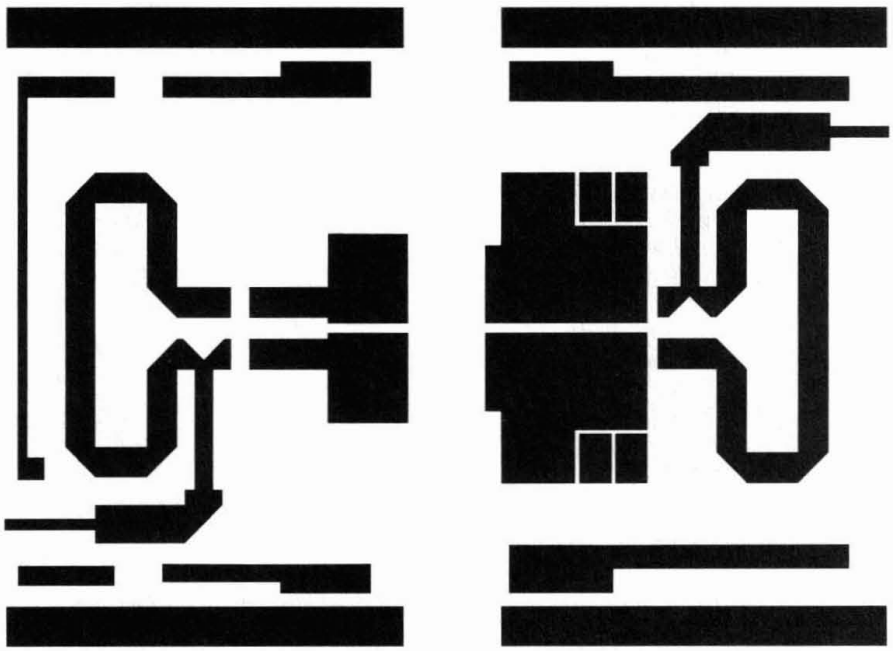
Schematic for f = 894 MHz

DUT	PTF 10100
C1-2	15 pF, Capacitor ATC 100 B
C3	0.6–6.0 pF, Variable Capacitor
C4	0.35–3.5 pF, Variable Capacitor
C5	1–9 pF, Variable Capacitor
C6-7, C10, C13-14, C18	33 pF, Capacitor ATC 100 B
C8, C11	10 µF, +10 V Tantalum
C9, C12, C15, C19	0.01 µF, Capacitor ATC 100 B
C16, C17, C20, C21	10 µF, +30 V Tantalum
C22	11 pF, Capacitor ATC 100 B
L1. L2	4 Turn, #20 AWG, .120" I.D.
R1, R2, R4, R5	510 Ω Resistor
R3, R6	510 Ω Resistor

ℓ1, ℓ20	50 Ω, .030 λ
ℓ2, ℓ17	20 Ω, .089 λ
ℓ3, ℓ16	9.6 Ω, .055 λ
ℓ4, ℓ15	25 Ω, .500 λ
ℓ5, ℓ6	25 Ω, .373 λ
ℓ7, ℓ8	12.2 Ω, .062 λ
ℓ9, ℓ10	13.0 Ω, .017 λ
ℓ11, ℓ12	6.6 Ω, .059 λ
ℓ13, ℓ14	9.6 Ω, .055 λ
Circuit Board	.028" Dielectric Thickness, ε_r = 4.0, AlliedSignal, G200, 2 oz. copper



Components Layout (not to scale)



Artwork (1 inch)

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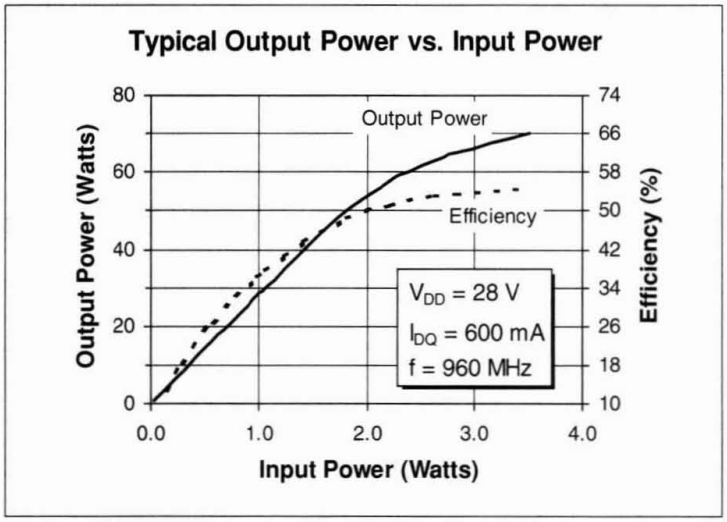
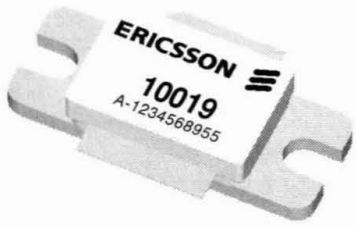
PTF 10019
70 Watts, 860–960 MHz
GOLDMOS™ Field Effect Transistor

Description

The PTF 10019 is an internally matched, 70 Watt LDMOS FET intended for cellular, GSM, and D-AMPS applications in the 860 to 960 MHz range. Nitride surface passivation and full gold metallization ensure excellent device lifetime and reliability.

- ***INTERNALLY MATCHED***
- **Performance at 960 MHz, 28 Volts**
  - **Output Power = 70 Watts**
  - **Power Gain = 14.5 dB Typ**
  - **Efficiency = 50% Typ**
- **Full Gold Metallization**
- **Silicon Nitride Passivated**
- **Excellent Thermal Stability**
- **100% Lot Traceability**





Package 20237

RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{DD} = 28 V, P_{out} = 70 W, I_{DQ} = 600 mA, f = 960 MHz)	G_{pe}	13.0	14.5	—	dB
Power Output at 1 dB Compression (V_{DD} = 28 V, I_{DQ} = 600 mA, f = 960 MHz)	P-1dB	70	75	—	Watts
Drain Efficiency (V_{DD} = 28 V, P_{out} = 70 W, I_{DQ} = 600 mA, f = 960 MHz)	η	45	50	—	%
Load Mismatch Tolerance (V_{DD} = 28 V, Pout = 70 W, I_{DQ} = 600 mA, f = 960 MHz —all phase angles at frequency of test)	Y	—	—	10:1	—

All published data at T_{CASE} = 25°C unless otherwise indicated.

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PTF 10019

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Electrical Characteristics (100% Tested)

Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 25 mA	$V_{(BR)DSS}$	65	—	—	Volts
Drain-Source Leakage Current	V_{DS} = 26 V, V_{GS} = 0 V	I_{DSS}	—	—	1.0	mA
Gate Threshold Voltage	V_{DS} = 10 V, I_D = 75 mA	$V_{GS(th)}$	3.0	—	5.0	Volts
Forward Transconductance	V_{DS} = 10 V, I_D = 3 A	g_{fs}	—	3.0	—	Siemens

Maximum Ratings

Parameter	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	65	Vdc
Gate-Source Voltage	V_{GS}	±20	Vdc
Operating Junction Temperature	T_J	200	°C
Total Device Dissipation Above 25°C derate by	P_D	215 1.25	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{CASE} = 70°C)	$R_{\theta JC}$	0.8	°C/W

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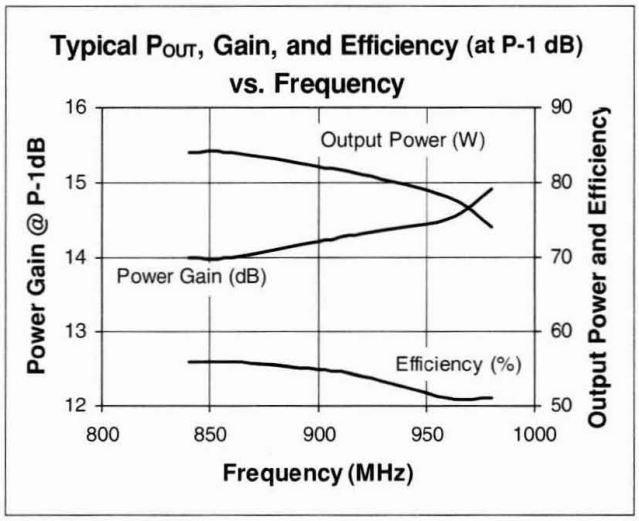
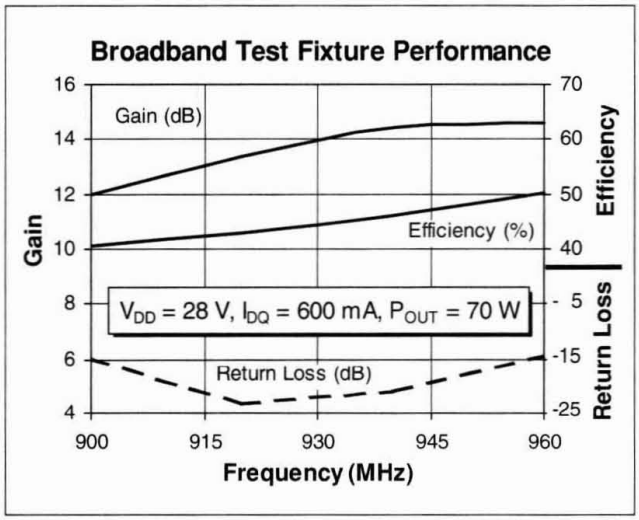
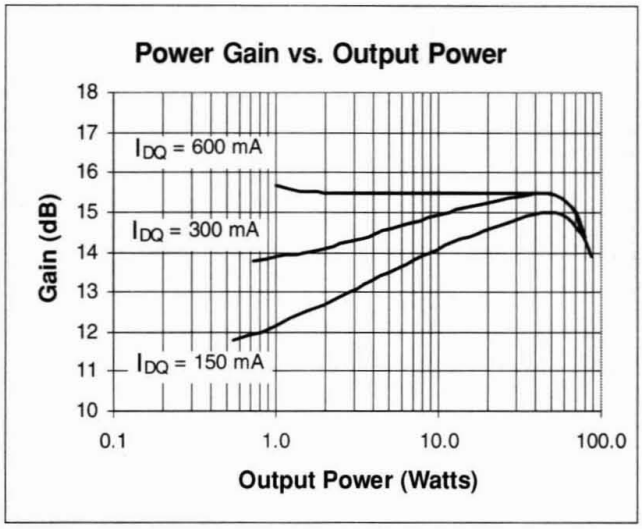
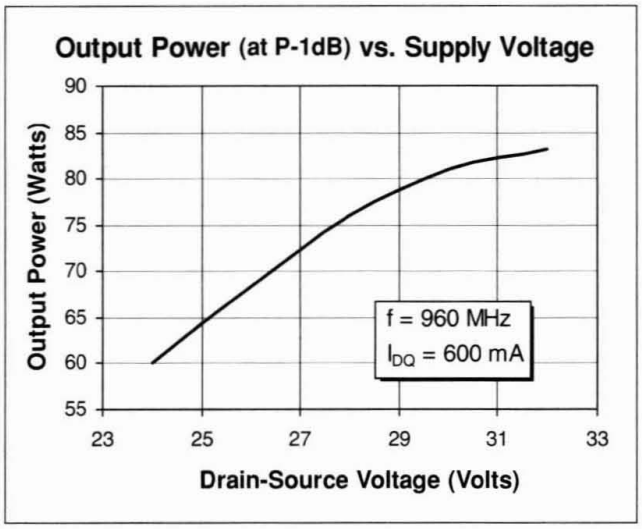
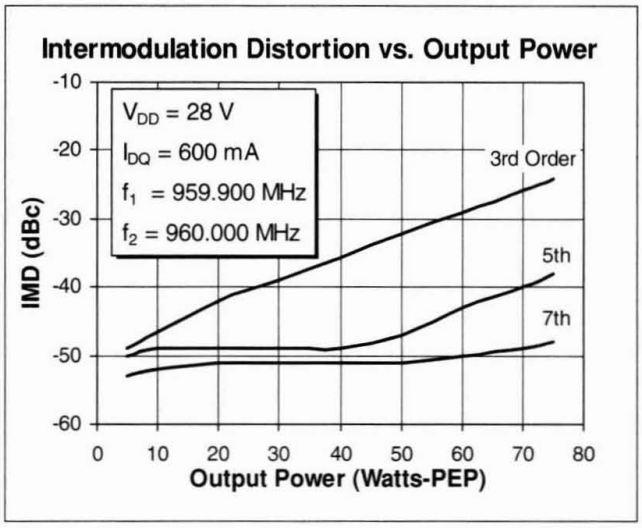
Typical Performance

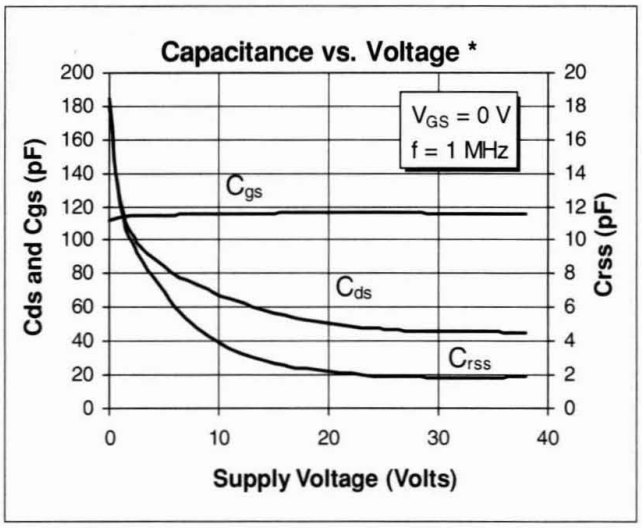




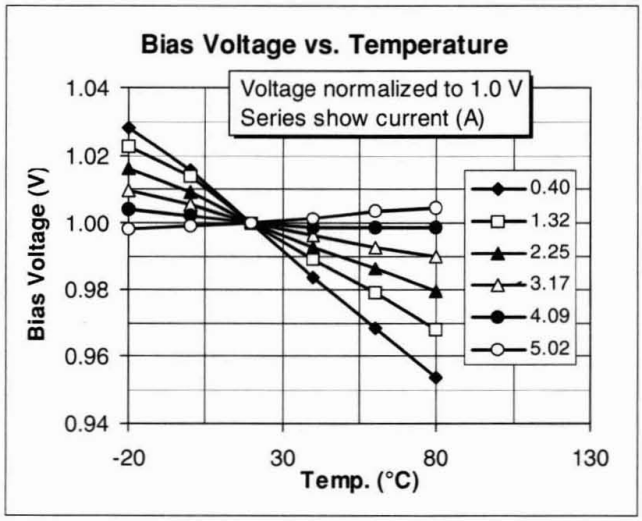






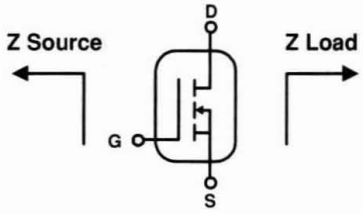


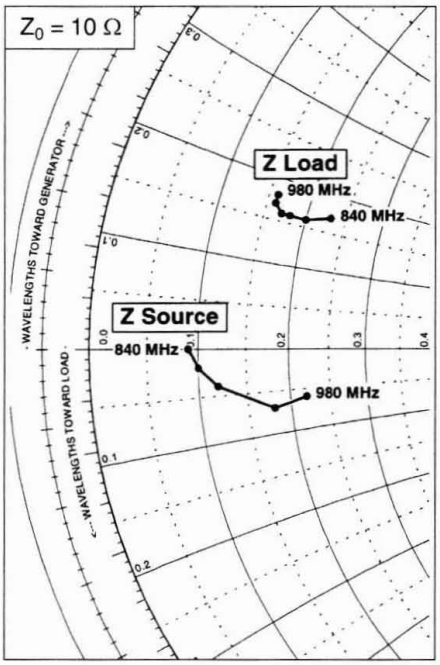
* This part is internally matched. Measurements of the finished product will not yield these figures.



Impedance Data

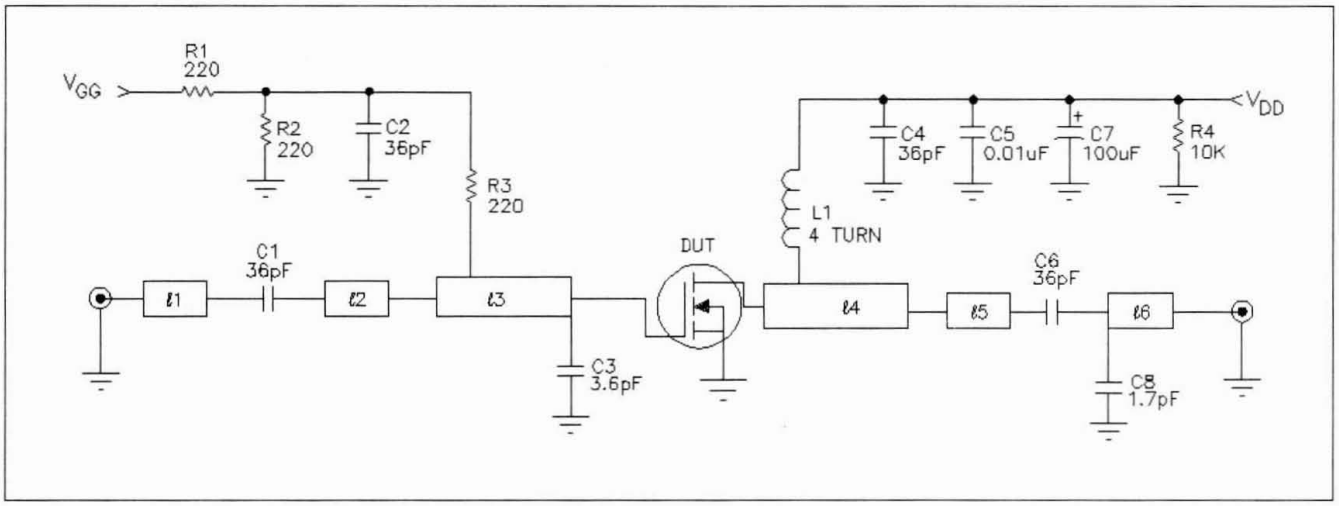
(V_{DD} = 28 V, Pout = 70 W, I_{DQ} = 600 mA)





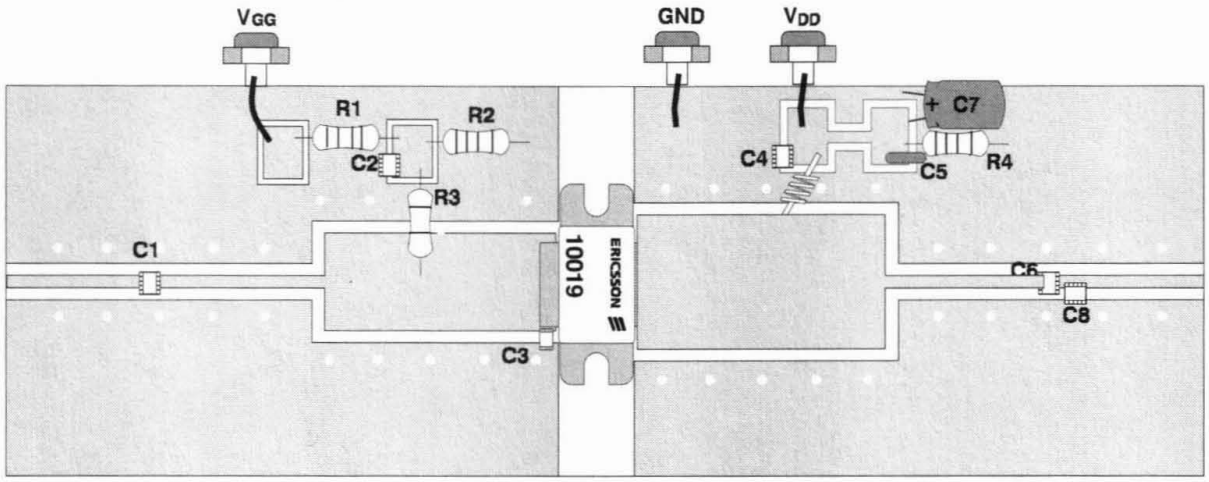
Frequency	Z Source Ω		Z Load Ω	
MHz	R	jX	R	jX
840	0.9	0	2.3	1.7
860	1.0	-0.2	2.0	1.6
900	1.2	-0.4	1.8	1.6
920	1.2	-0.4	1.7	1.6
960	1.8	-0.7	1.6	1.7
980	2.2	-0.6	1.6	1.8

Test Circuit

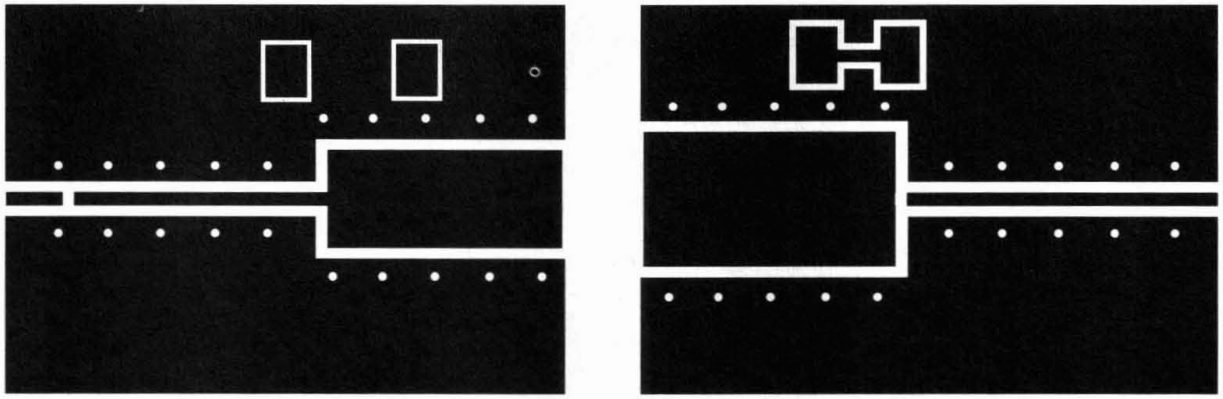


Test Circuit Schematic for f = 960 MHz

DUT	PTF 10019	LDMOS Field Effect Transistor
ℓ1, ℓ6	Microstrip 50 Ω	
ℓ2	0.125 λ 960 GHz	Microstrip 50 Ω
ℓ3	0.186 λ 960 GHz	Microstrip 10 Ω
ℓ4	0.200 λ 960 GHz	Microstrip 7.5 Ω
ℓ5	0.060 λ 960 GHz	Microstrip 50 Ω
C1, C2, C4, C6	36 pF	Chip Cap ATC 100 B
C3	3.6 pF	Chip Cap ATC 100 A
C5	0.01 μF	Capacitor Digi-Key P4917-ND
C7	50 μF, 35 V	Electrolytic Capacitor, Digi-Key P5276
C8	1.7 pF	Chip Cap ATC 100 B
L1	4 Turn, #20 AWG, .120"I.D.	
R1, R2, R3	220 Ω, 1/4 W Resistor	
R4	10K Ω, 1/4 W Resistor	
Circuit Board	.028" Dielectric Thickness, ε_r = 4.0, AlliedSignal, G200, 2 oz. copper	



Components Layout (not to scale)



Artwork (1 inch)

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Specifications subject to change without notice.
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EUS/KR 1301-PTF 10019 Uen Rev. A 10-22-99

PRELIMINARY PTF 10160*

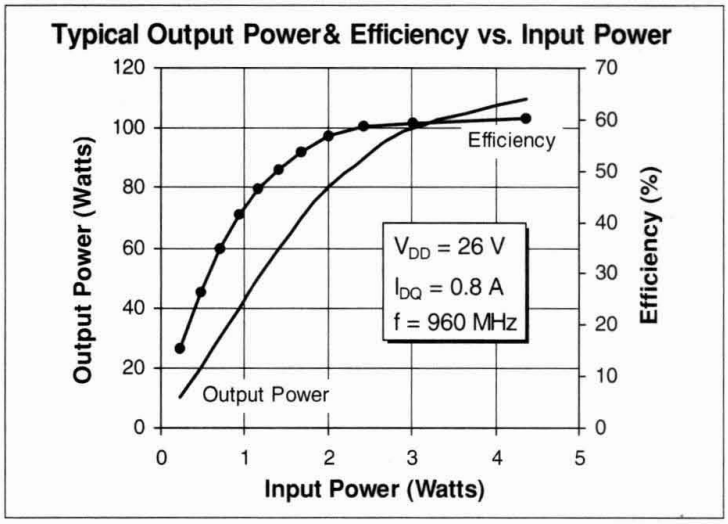
85 Watts, 860–960 MHz

GOLDMOS™ Field Effect Transistor

Description

The 10160 is an input and output matched 85 watt LDMOS FET intended for cellular, GSM, D-AMPS and EDGE applications. This device operates at 53% efficiency with 15 dB of gain minimum. Full gold metallization ensures excellent device lifetime and reliability.

- ***INTERNALLY MATCHED***
- **Performance at 960 MHz, 26 Volts**
  - **Output Power = 85 Watts**
  - **Power Gain = 16 dB Typ**
  - **Efficiency = 53% Typ**
- **Full Gold Metallization**
- **Silicon Nitride Passivated**
- **Excellent Thermal Stability**
- **100% Lot Traceability**



Package 20248

RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{DD} = 26 V, P_{OUT} = 85 W, I_{DQ} = 800 mA, f = 960 MHz)	G_{pe}	15	16	—	dB
Power Output at 1 dB Compression (V_{DD} = 26 V, I_{DQ} = 800 mA, f = 960 MHz)	P-1dB	85	90	—	Watts
Drain Efficiency (V_{DD} = 26 V, P_{OUT} = 85 W, I_{DQ} = 800 mA, f = 960 MHz)	η	50	53	—	%
Load Mismatch Tolerance (V_{DD} = 26 V, P_{OUT} = 85 W, I_{DQ} = 800 mA, f = 960 MHz —all phase angles at frequency of test)	Ψ	—	—	10:1	—

All published data at T_{CASE} = 25°C unless otherwise indicated.

* Note: Specifications for this product are preliminary and subject to change without notice. Please contact your sales representative for further product information. Complete product infromation is available on our Website at: www.ericsson.com/rfpower.

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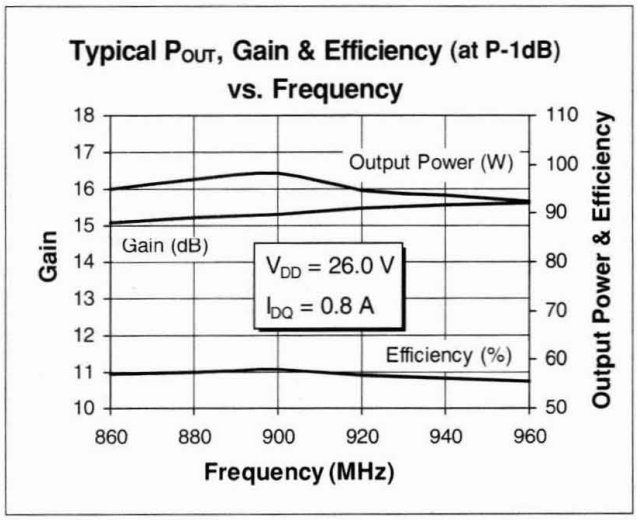
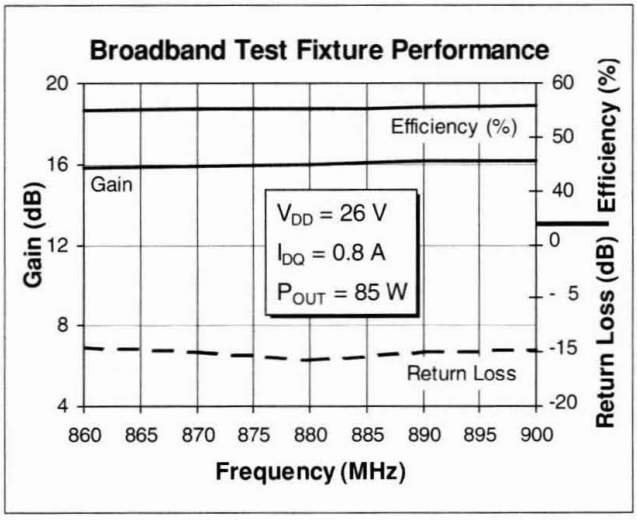
Electrical Characteristics (100% Tested)

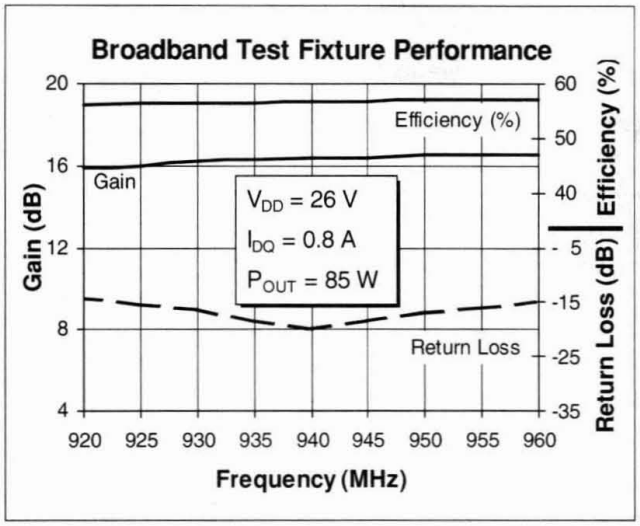
Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 25 mA	$V_{(BR)DSS}$	65	—	—	Volts
Drain-Source Leakage Current	V_{DS} = 26 V, V_{GS} = 0 V	I_{DSS}	—	—	1.0	mA
Gate Threshold Voltage	V_{DS} = 10 V, I_D = 75 mA	$V_{GS(th)}$	3.0	—	5.0	Volts
Forward Transconductance	V_{DS} = 10 V, I_D = 3 A	g_{fs}	—	3.0	—	Siemens

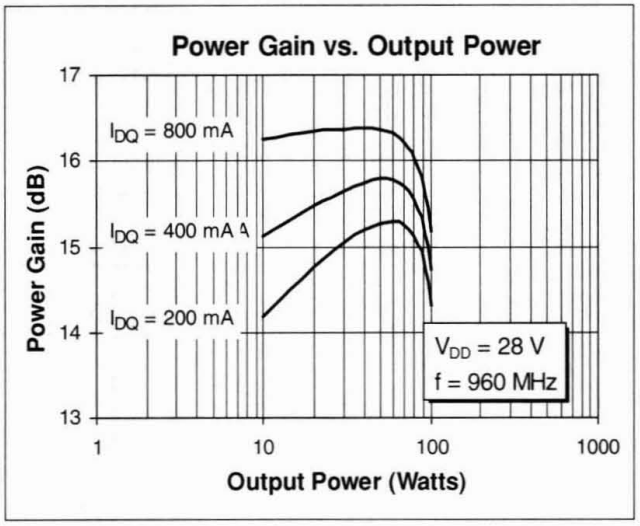
Maximum Ratings

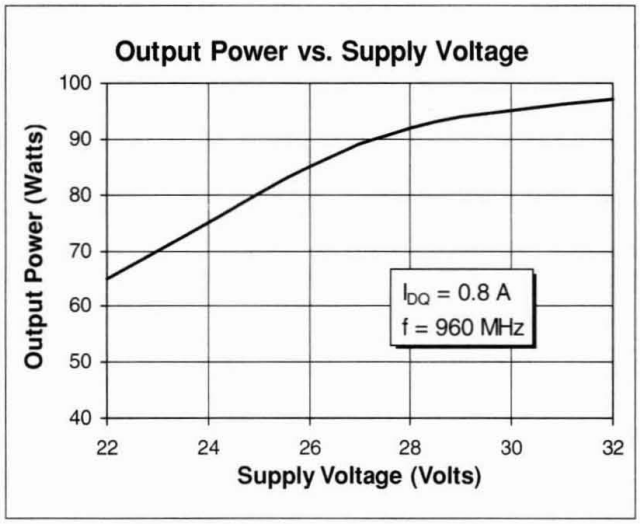
Parameter	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	65	Vdc
Gate-Source Voltage	V_{GS}	±20	Vdc
Operating Junction Temperature	T_J	200	°C
Total Device Dissipation Above 25°C derate by	P_D	205 1.18	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{CASE} = 70°C)	$R_{\theta JC}$	0.85	°C/W

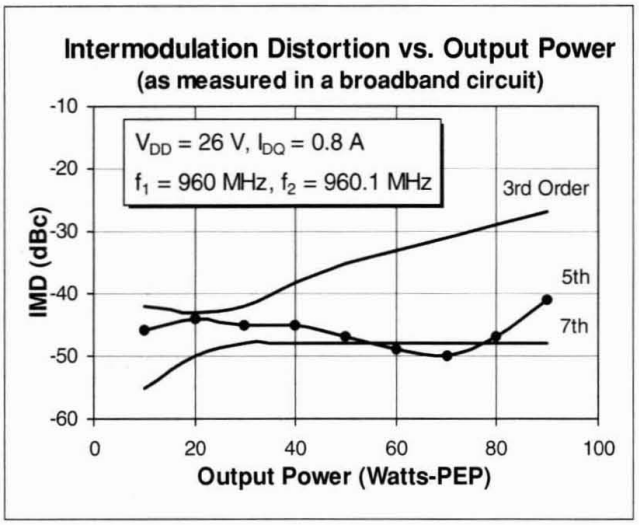


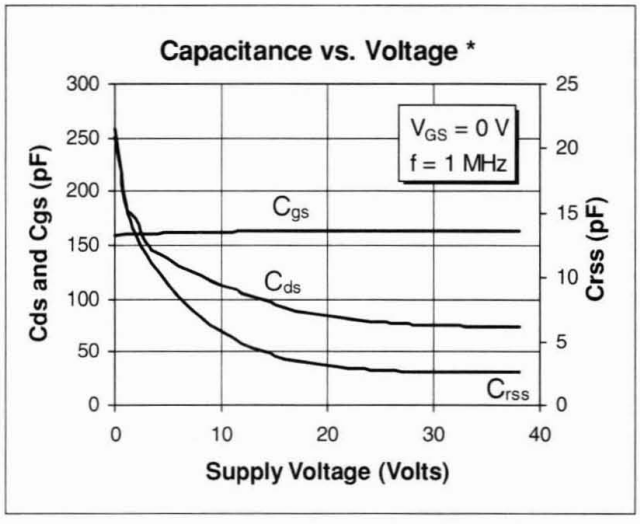


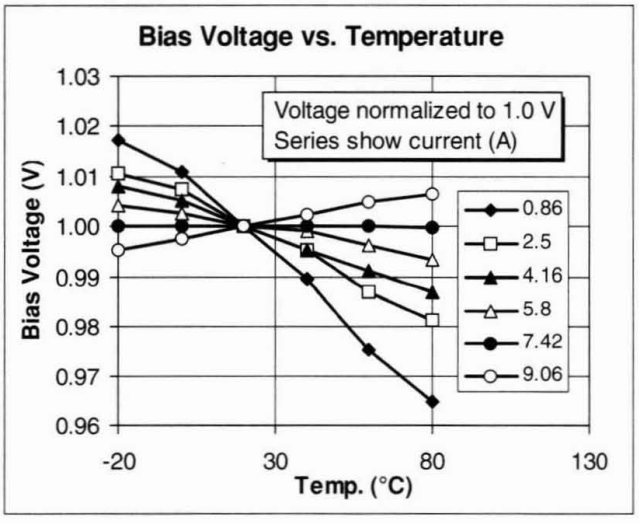






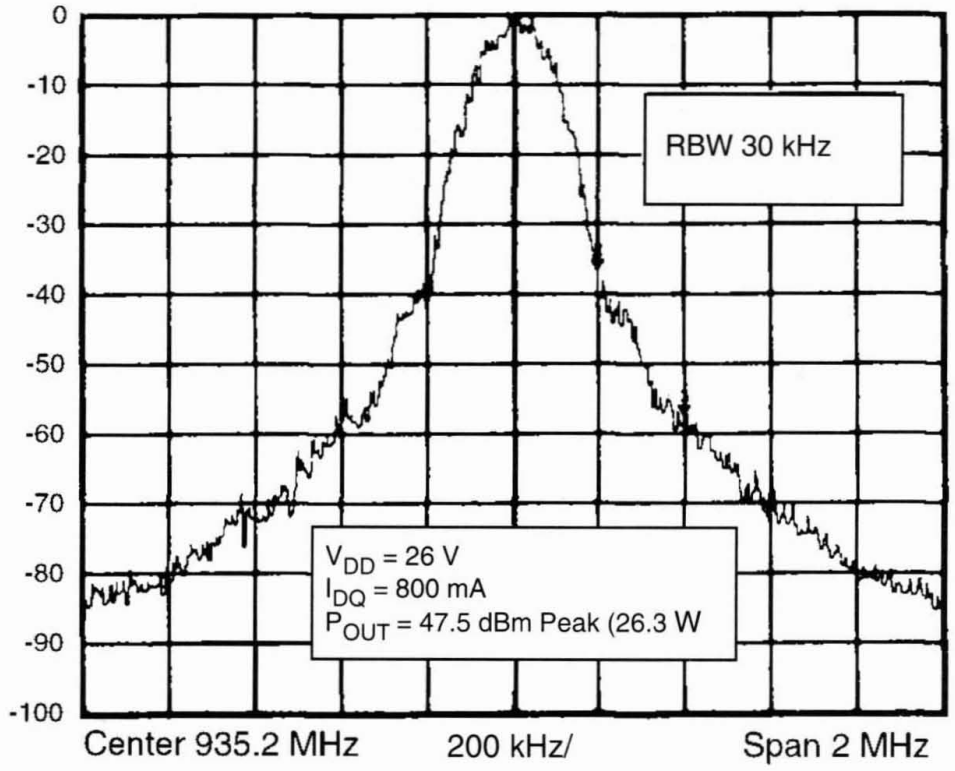

Intermodulation Distortion vs. Output Power
(as measured in a broadband circuit)
V_{DD} = 26 V, I_{DQ} = 0.8 A
f_1 = 960 MHz, f_2 = 960.1 MHz
3rd Order
5th
7th
IMD (dBc)
Output Power (Watts-PEP)





* This part is internally matched. Measurements of the finished product will not yield these figures.

Spectrum Due to Modulation (Edge Modulation)



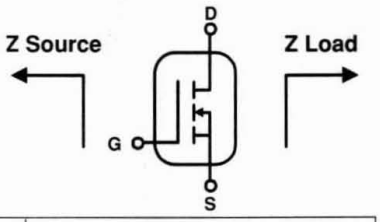
Without correction circuit

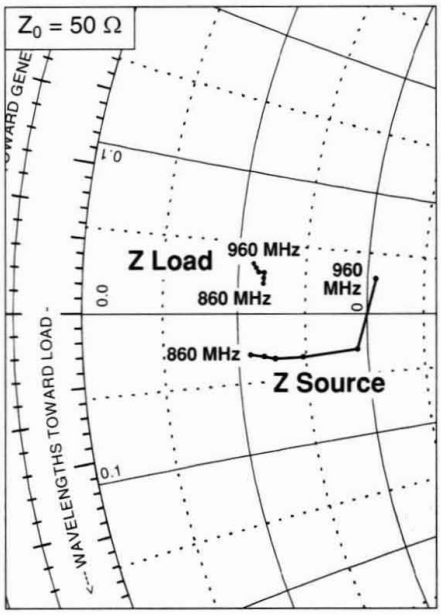
200 kHz = -36 dBc

400 kHz = -57 dBc

Impedance Data

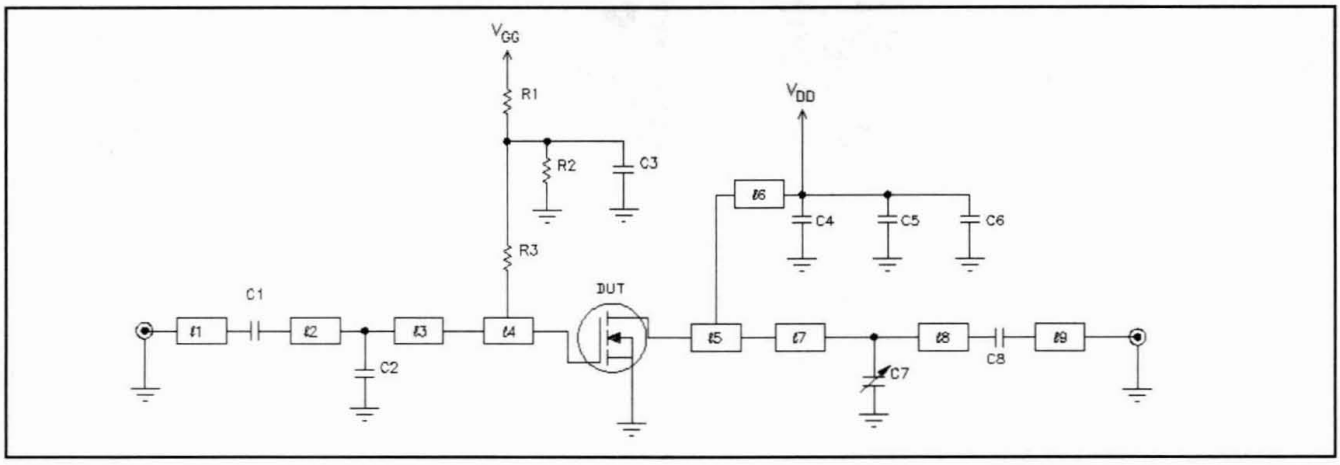
V_{DD} = 26 V, P_{OUT} = 85 W, I_{DQ} = 800 mA





Frequency	Z Source Ω		Z Load Ω	
MHz	R	jX	R	jX
860	2.1	-1.5	2.6	1.1
880	2.6	-1.6	2.6	1.3
900	3	-1.7	2.6	1.5
920	4.1	-1.7	2.4	1.5
940	6.3	-1.5	2.3	1.65
960	7.1	1.5	2.2	1.8

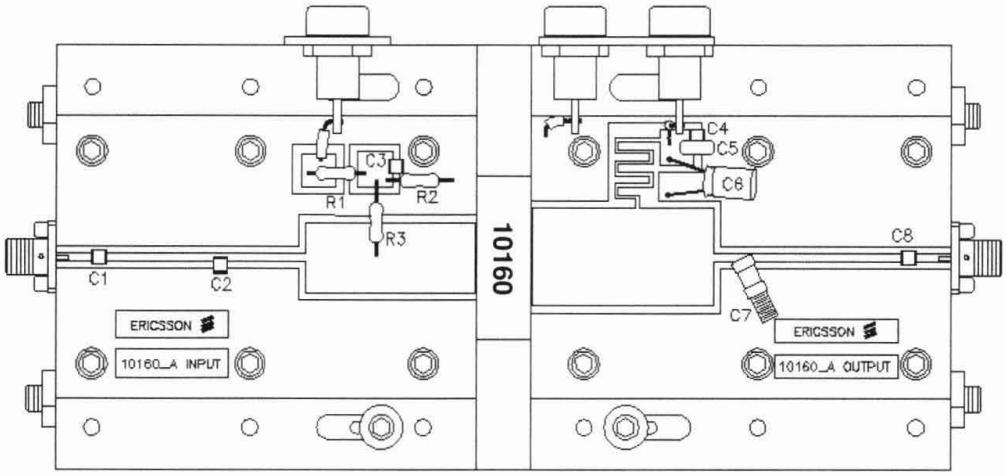
Test Circuit



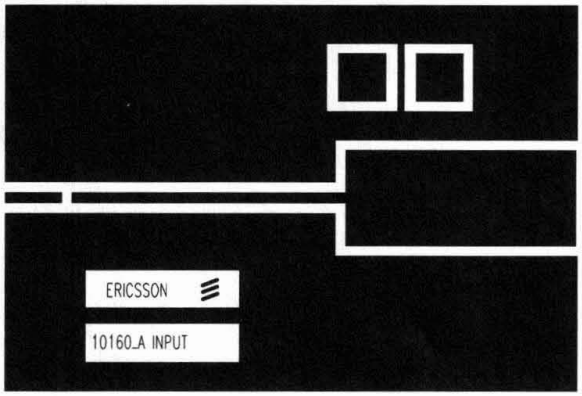
Test Circuit Schematic for f = 960 MHz

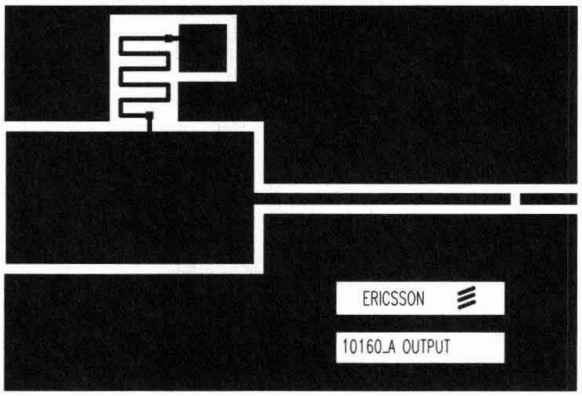
DUT	PTF 10160	LDMOS Transistor
ℓ1, ℓ9	0.037 λ	Microstrip 50 Ω
ℓ2	0.128 λ	Microstrip 50 Ω
ℓ3	0.076 λ	Microstrip 50 Ω
ℓ4	0.187 λ	Microstrip 9.29 Ω
ℓ5	0.204 λ	Microstrip 6.98 Ω
ℓ6	0.250 λ	Microstrip 77.9 Ω
ℓ7	0.031 λ	Microstrip 50 Ω
ℓ8	0.157 λ	Microstrip 50 Ω

C1, C3, C4, C8	ATC 100 B	Capacitor, 36 pF
C2	ATC 100 B	Capacitor, 4.3 pF
C5	Digi-Key P4525-ND	Capacitor, 0.1 µF, 50 V
C6	Digi-Key P5182-ND	Capacitor, 100 µF, 50 V
C7	ATC 100 B	Capacitor, 0.35-3.5 pF
Circuit Board	.030" Dielectric Thickness, ε_r = 4.0, AlliedSignal, G200, 2 oz. copper	



Components Layout (not to scale)





Artwork (1 inch *)*

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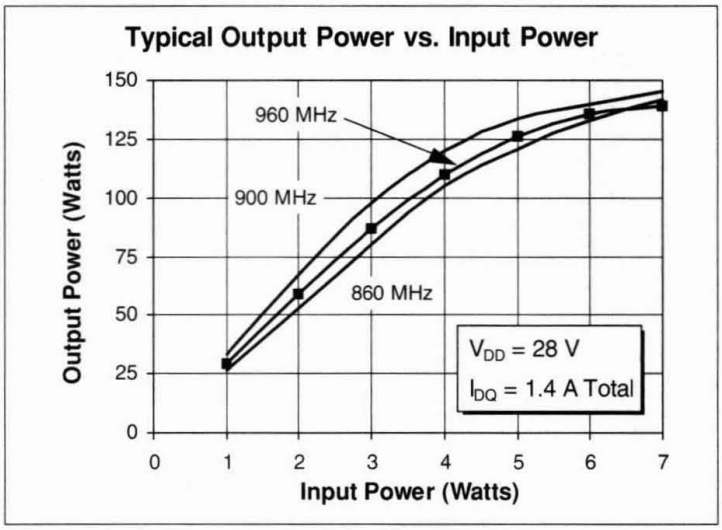
EUS/KR 1301-PTF 10160 Uen Rev. A 01-14-00

PTF 10020
125 Watts, 860–960 MHz
GOLDMOS™ Field Effect Transistor

Description

The PTF 10020 is an internally matched, 125 Watt LDMOS FET intended for large signal amplifier applications from 860 to 960 MHz. Nitride surface passivation and gold metallization ensure excellent device lifetime and reliability.

- ***INTERNALLY MATCHED***
- **Performance at 960 MHz, 28 Volts**
  - **Output Power = 125 Watts**
  - **Power Gain = 12.5 dB Typ**
  - **Efficiency = 55% Typ**
- **Full Gold Metallization**
- **Silicon Nitride Passivated**
- **Back Side Common Source**
- **100% Lot Traceability**



Package 20240

RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{DD} = 28 V, P_{OUT} = 125 W, I_{DQ} = 1.4 A Total, f = 960 MHz)	G_{ps}	11.0	12.5	—	dB
Power Output at 1 dB Compression (V_{DD} = 28 V, I_{CQ} = 1.4 A Total, f = 960 MHz)	P-1dB	125	130	—	Watts
Drain Efficiency (V_{DD} = 28 V, P_{OUT} = 125 W, I_{DQ} = 1.4 A Total, f = 960 MHz)	η	50	55	—	%
Load Mismatch Tolerance (V_{DD} = 28 V, P_{OUT} = 125 W(PEP), I_{DQ} = 1.4 A Total, f = 959.9, 960 MHz—all phase angles at frequency of test)	Ψ	—	—	10:1	—

All published data at T_{CASE} = 25°C unless otherwise indicated.

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PTF 10020

ERICSSON

Electrical Characteristics (100% Tested—characteristics, conditions and limits shown per side)

Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 5 mA	$V_{(BR)DSS}$	65	—	—	Volts
Drain-Source Leakage Current	V_{DS} = 28 V, V_{GS} = 0 V	I_{DSS}	—	—	1.0	mA
Gate Threshold Voltage	V_{DS} = 10 V, I_D = 75 mA	$V_{GS(th)}$	3.0	4.3	5.0	Volts
Forward Transconductance	V_{DS} = 10 V, I_D = 3 A	g_{fs}	—	2.5	—	Siemens

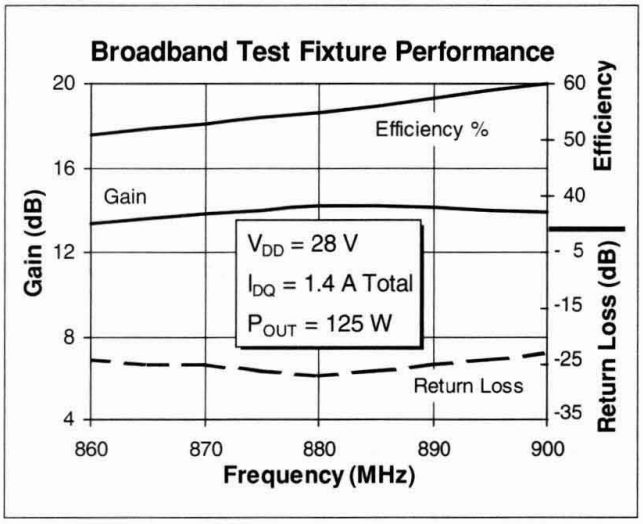
Maximum Ratings

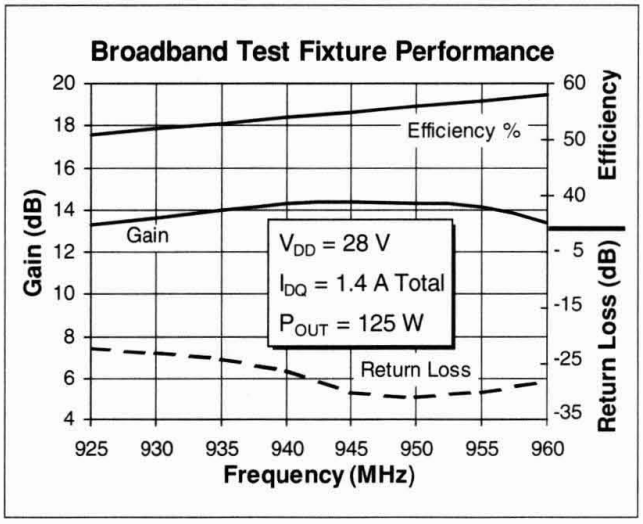
Parameter	Symbol	Value	Unit
Drain-Source Voltage (1)	V_{DSS}	65	Vdc
Gate-Source Voltage (1)	V_{GS}	±20	Vdc
Operating Junction Temperature	T_J	200	°C
Total Device Dissipation at Above 25°C derate by	P_D	290 1.67	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{CASE} = 70°C)	$R_{\theta JC}$	0.6	°C/W

(1)per side

GOLDMOS™

Typical Performance





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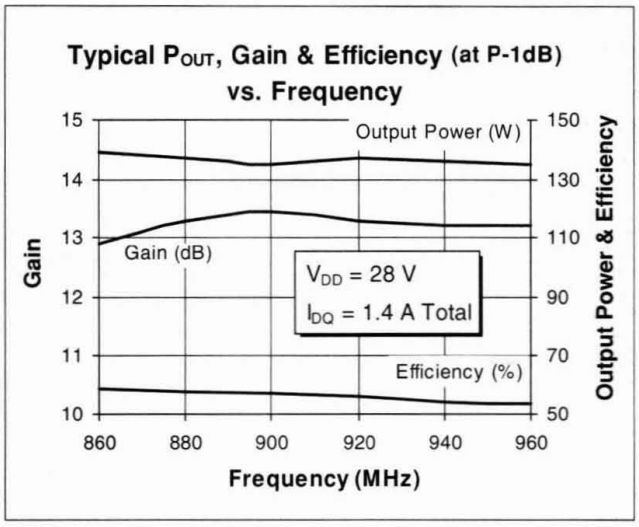
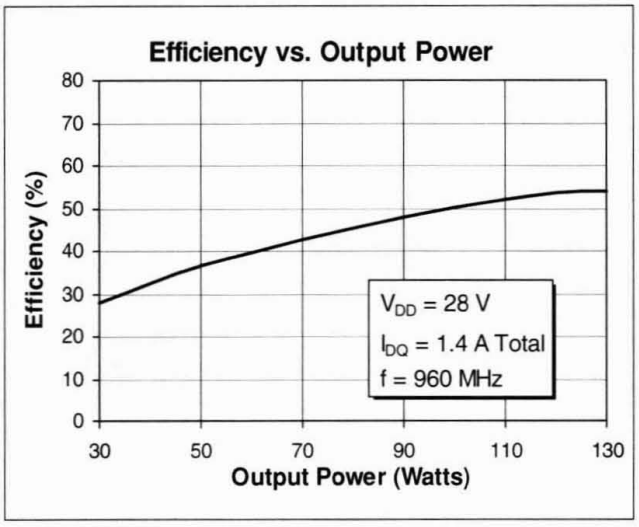
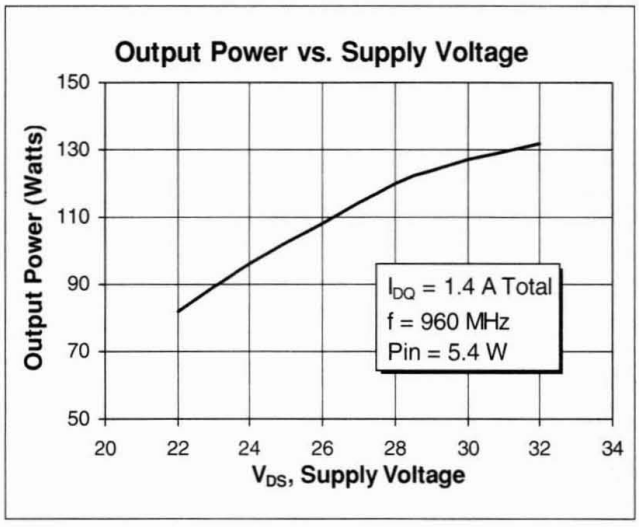
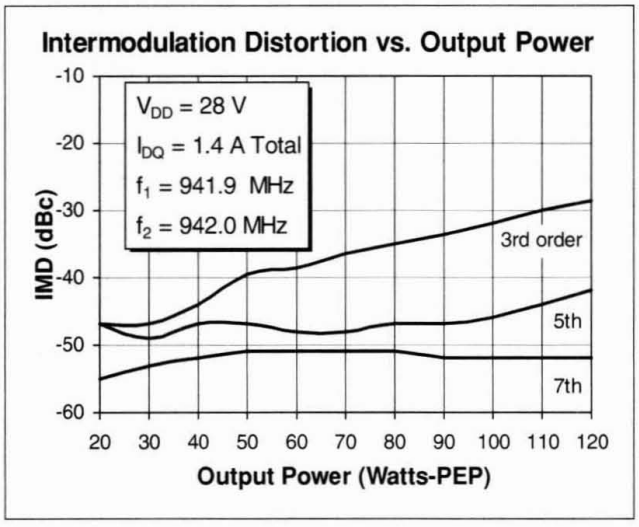
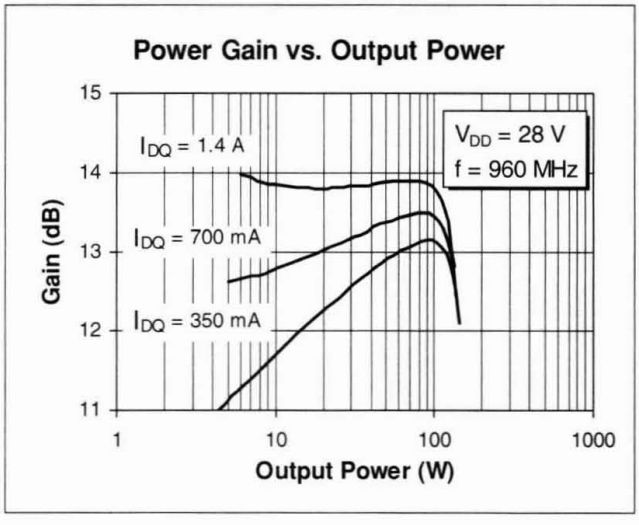
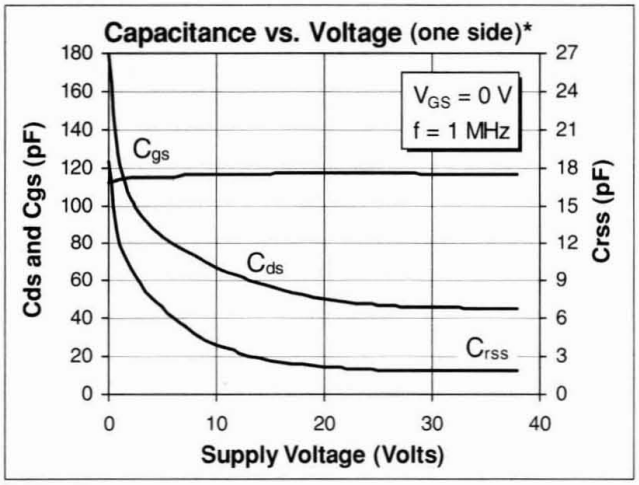






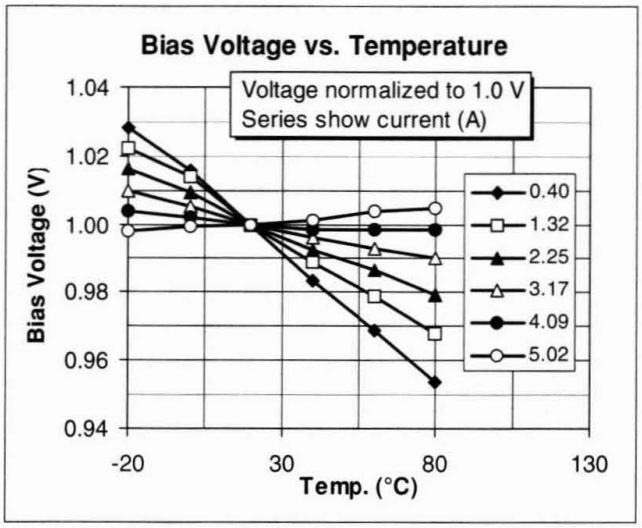






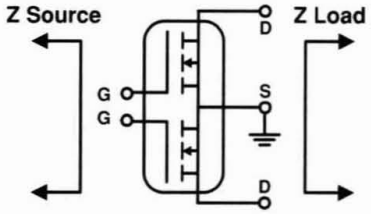
*This part is internally matched. Measurements of the finished product will not yield these figures.

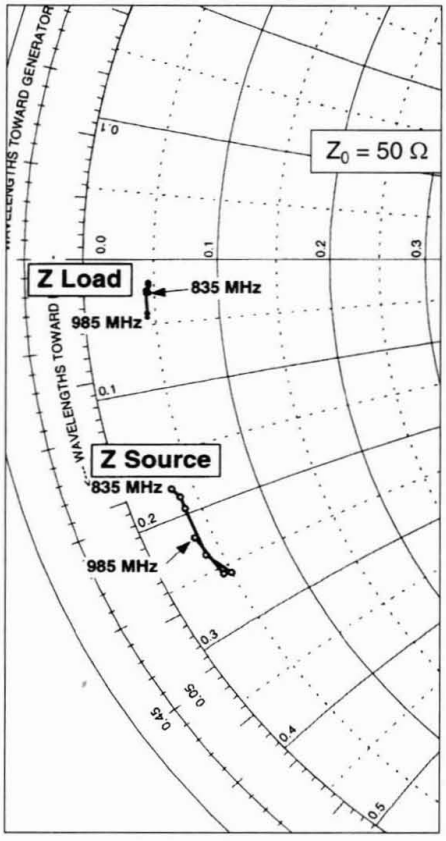
Typical Performance



Impedance Data

(V_{DD} = 28 V, I_{DQ} = 1.4 A, P_{OUT} = 125 W)





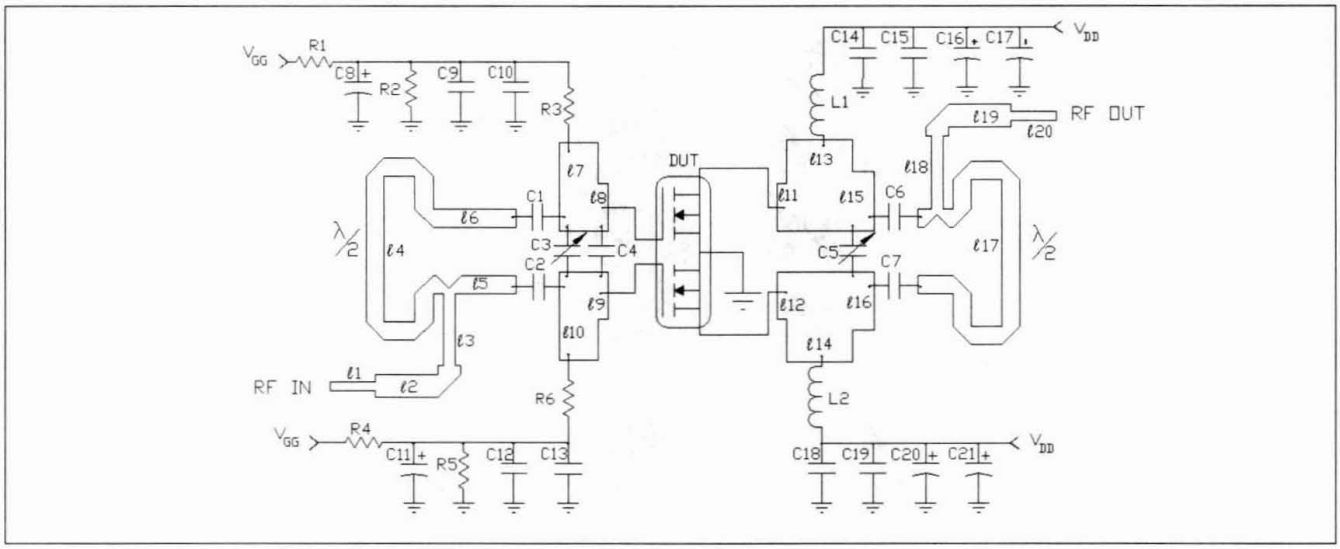
Frequency	Z Source Ω		Z Load Ω	
MHz	R	jX	R	jX
835	1.7	-8.9	2.3	-1.3
860	1.9	-9.3	2.3	-0.9
885	1.9	-9.8	2.3	-1.0
910	1.9	-11.8	2.2	-1.2
935	2.5	-12.9	2.2	-1.3
960	2.2	-12.8	2.2	-2.1
985	1.8	-11.0	2.2	-2.2

Typical Scattering Parameters (one side only)

(V_{DS} = 28 V, I_D = 4 A)

f	S11		S21		S12		S22	
(MHz)	Mag	Ang	Mag	Ang	Mag	Ang	Mag	Ang
800	0.974	176	0.657	-10.6	0.002	50.9	0.97	-172
810	0.974	175.9	0.66	-11.5	0.002	49	0.971	-172.1
820	0.974	175.7	0.662	-12.7	0.002	52.9	0.971	-172.3
830	0.974	175.6	0.666	-13.6	0.002	53.4	0.972	-172.4
840	0.972	175.4	0.669	-14.8	0.002	52.6	0.972	-172.5
850	0.972	175.4	0.672	-16	0.002	54.9	0.972	-172.7
860	0.971	175.2	0.674	-16.9	0.002	56.1	0.972	-172.8
870	0.969	175	0.679	-18	0.002	52.5	0.972	-172.8
880	0.968	174.9	0.686	-19.1	0.002	53.4	0.973	-173
890	0.966	174.8	0.695	-20.2	0.002	56.2	0.975	-173.1
900	0.964	174.7	0.705	-21.4	0.002	58.1	0.977	-173.2
910	0.963	174.6	0.716	-23	0.002	55.5	0.977	-173.4
920	0.961	174.3	0.729	-24.6	0.002	57.7	0.976	-173.6
930	0.958	174.2	0.743	-26.3	0.002	57	0.977	-173.6
940	0.956	174.1	0.757	-28.2	0.002	56.7	0.978	-173.8
950	0.953	174	0.774	-30.3	0.002	58.7	0.979	-174
960	0.95	173.8	0.791	-32.7	0.002	60.2	0.979	-173.9
970	0.946	173.8	0.807	-35.4	0.002	60	0.981	-174.1
980	0.942	173.7	0.821	-38.1	0.002	59.5	0.982	-174.2
990	0.937	173.6	0.838	-41	0.002	62	0.983	-174.3
1000	0.933	173.6	0.853	-44	0.002	62.2	0.983	-174.4

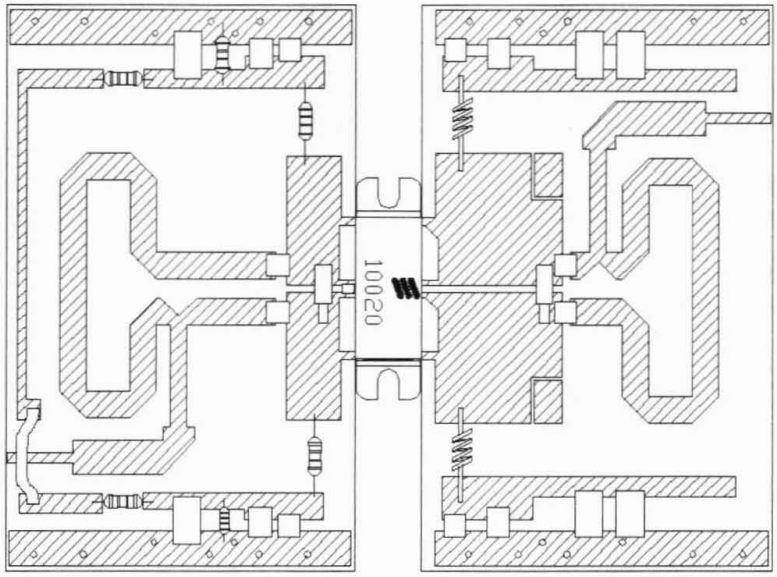
Test Circuit



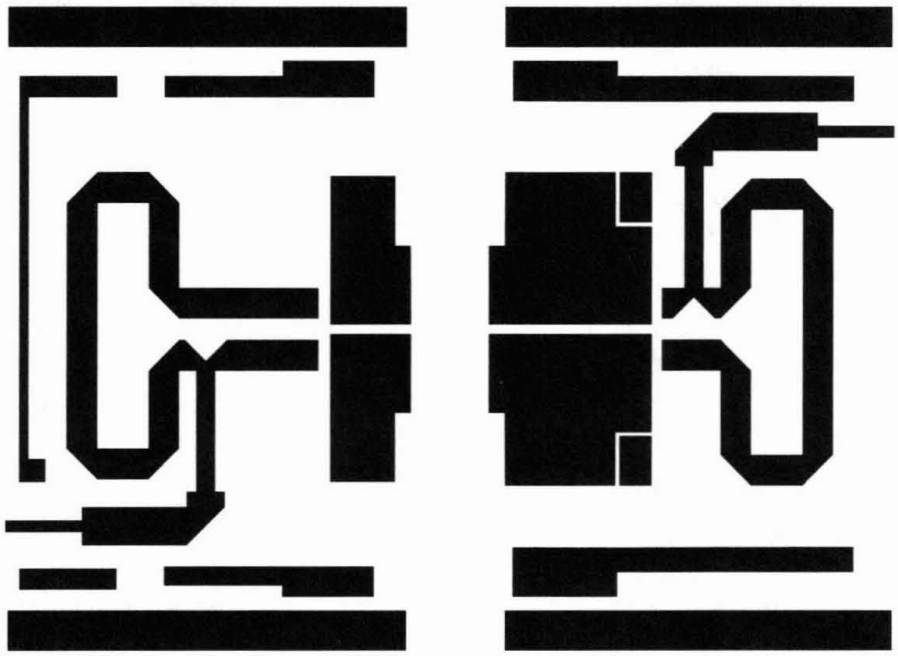
Schematic for f = 960 MHz

DUT	PTF 10020
C1-2	15 pF, Capacitor ATC 100 B
C3	0.35–3.5 pF, Variable Capacitor
C4	7.5 pF, Capacitor ATC 100 A
C5	1–9 pF, Variable Capacitor
C6-7, C10, C13-14, C18	33 pF, Capacitor ATC 100 B
C8, C11	10 µF, +10 V Electrolytic Capacitor
C9, C12, C15, C19	0.01 µF, Capacitor ATC 100 B
C16, C17, C20, C21	10 µF, +30 V Electrolytic Capacitor
L1. L2	4 Turn, #20 AWG, .120" I.D.
R1, R2, R4, R5	1.0 K, Ω Resistor
R3, R6	5.1 K, 1/4 Ω Resistor

ℓ1, ℓ20	50 Ω, .030 λ
ℓ2, ℓ19	20 Ω, .080 λ
ℓ3, ℓ18	32 Ω, .191 λ
ℓ4, ℓ17	25 Ω, .500 λ
ℓ5, ℓ6	25 Ω, .091 λ
ℓ7, ℓ10	7 Ω, .056 λ
ℓ8, ℓ9	13.0 Ω, .017 λ
ℓ11, ℓ12	13.0 Ω, .017 λ
ℓ13, ℓ14	7.0 Ω, .093 λ
ℓ15, ℓ16	10.2 Ω, .030 λ
Circuit Board	.028" Dielectric Thickness, ε_r = 4.0, AlliedSignal, G200, 2 oz. copper



Components Layout (not to scale)



Artwork (1 inch)

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L3
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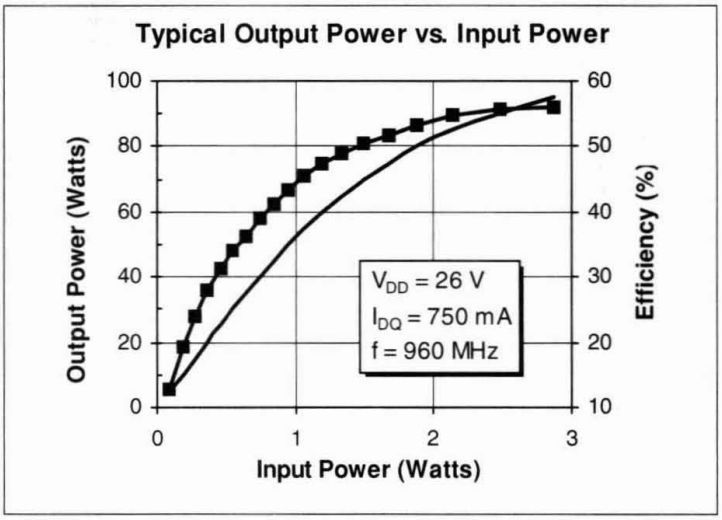
EUS/KR 1301-PTF 10020 Uen Rev. A 06-10-98

PTF 10149
70 Watts, 921–960 MHz
GOLDMOS™ Field Effect Transistor

Description

The PTF 10149 is an internally matched, 70 Watt LDMOS FET intended for cellular and GSM amplifier applications from 921–960 MHz. This device operates at 50% efficiency with 16 dB of gain. Nitride surface passivation and full gold metallization ensure excellent device lifetime and reliability.

- ***INTERNALLY MATCHED***
- **Performance at 960 MHz, 26 Volts**
  - **Output Power = 70 Watts**
  - **Power Gain = 16.0 dB Typ**
  - **Efficiency = 50% Typ**
- **Full Gold Metallization**
- **Silicon Nitride Passivated**
- **Excellent Thermal Stability**
- **100% Lot Traceability**



Package 20252

RF Specifications (100% tested)

Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{DD} = 26 V, P_{OUT} = 70 W, I_{DQ} = 750 mA, f = 960 MHz)	G_{pe}	15.0	16.0	—	dB
Power Output at 1 dB Compression (V_{DD} = 26 V, I_{DQ} = 750 mA, f = 960 MHz)	P-1dB	70	75	—	Watts
Drain Efficiency (V_{DD} = 26 V, P_{OUT} = 70 W, I_{DQ} = 750 mA, f = 960 MHz)	η	47	50	—	%
Load Mismatch Tolerance (V_{DD} = 26 V, P_{OUT} = 70 W, I_{DQ} = 750 mA, f = 921 MHz —all phase angles at frequency of test)	Ψ	—	—	5:1	—

All published data at T_{CASE} = 25°C unless otherwise indicated.

ERICSSON

PTF 10149

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Electrical Characteristics (100% Tested)

Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 25 mA	$V_{(BR)DSS}$	65	—	—	Volts
Drain-Source Leakage Current	V_{DS} = 26 V, V_{GS} = 0 V	I_{DSS}	—	—	1.0	mA
Gate Threshold Voltage	V_{DS} = 10 V, I_D = 75 mA	$V_{GS(th)}$	3.0	—	5.0	Volts
Forward Transconductance	V_{DS} = 10 V, I_D = 3 A	g_{fs}	—	3.0	—	Siemens

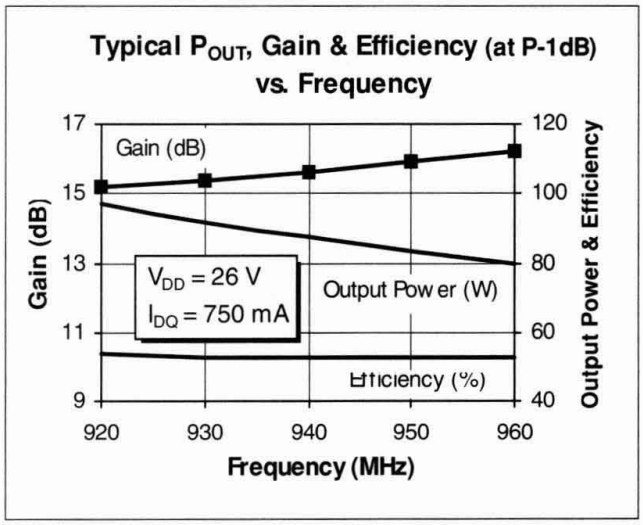
Maximum Ratings

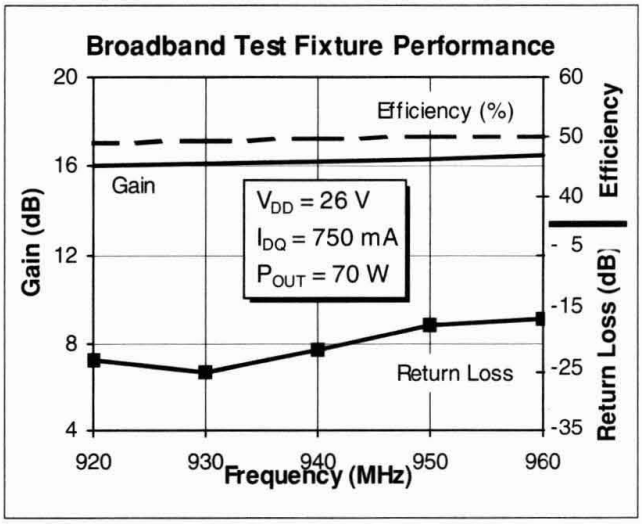
Parameter	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	65	Vdc
Gate-Source Voltage	V_{GS}	±20	Vdc
Operating Junction Temperature	T_J	200	°C
Total Device Dissipation Above 25°C derate by	P_D	197 1.12	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{CASE} = 70°C)	$R_{\theta JC}$	0.89	°C/W

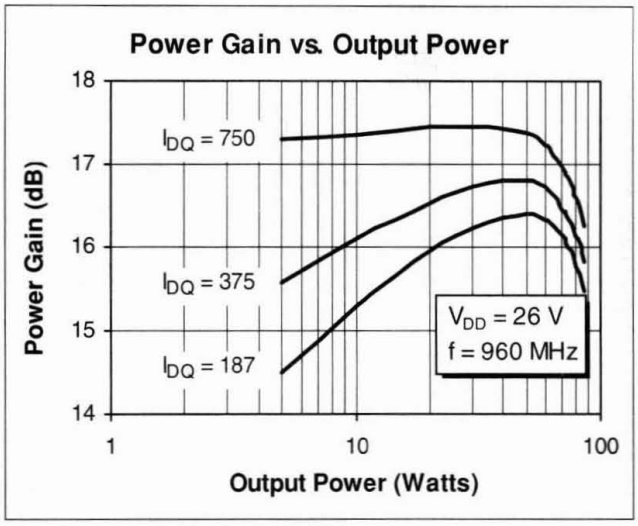
GOLDMOS™

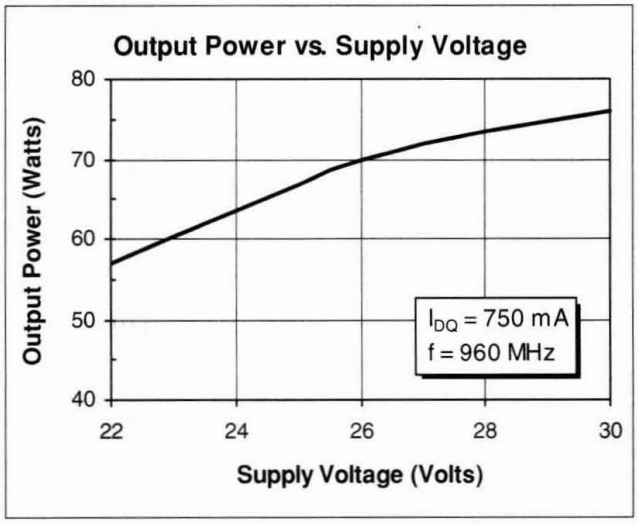
3

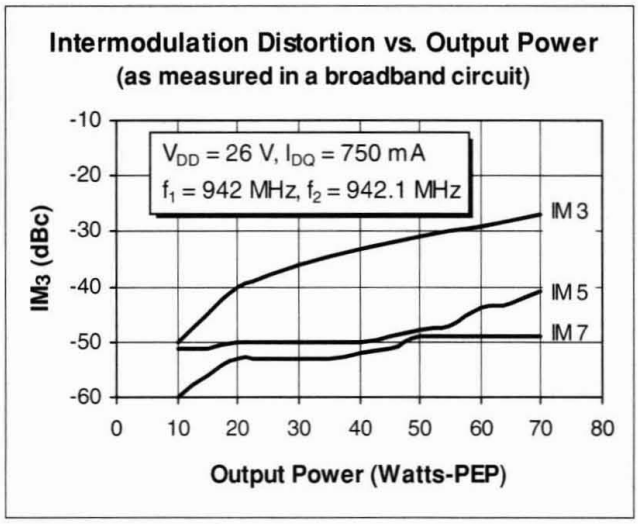
Typical Performance

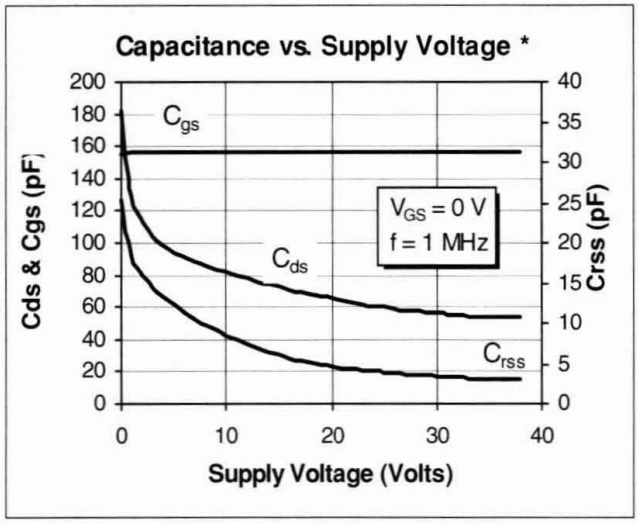




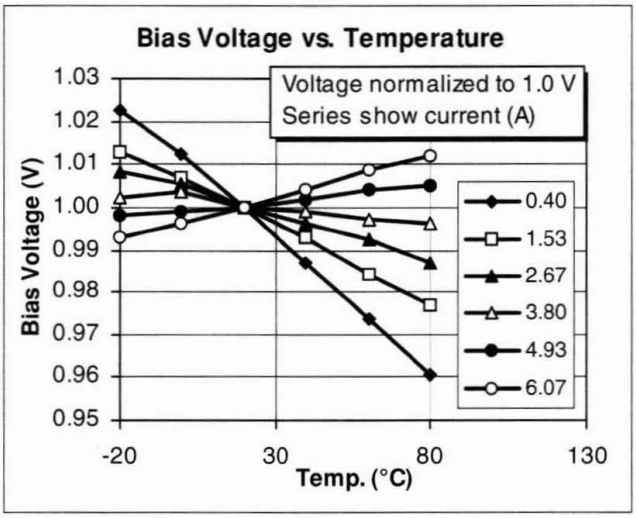






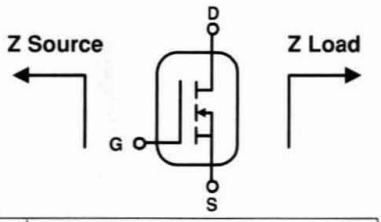


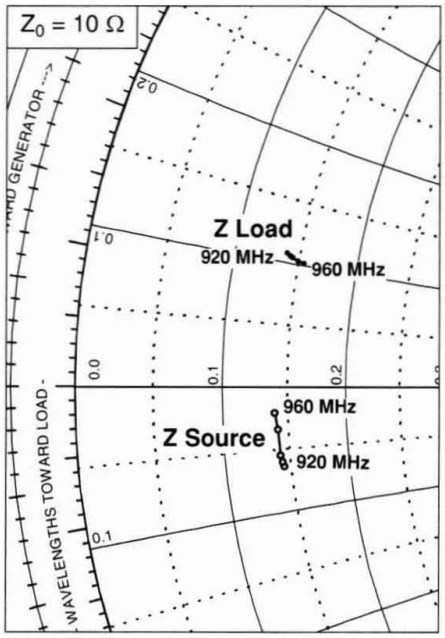
* This part is internally matched. Measurements of the finished product will not yield these figures.



Impedance Data

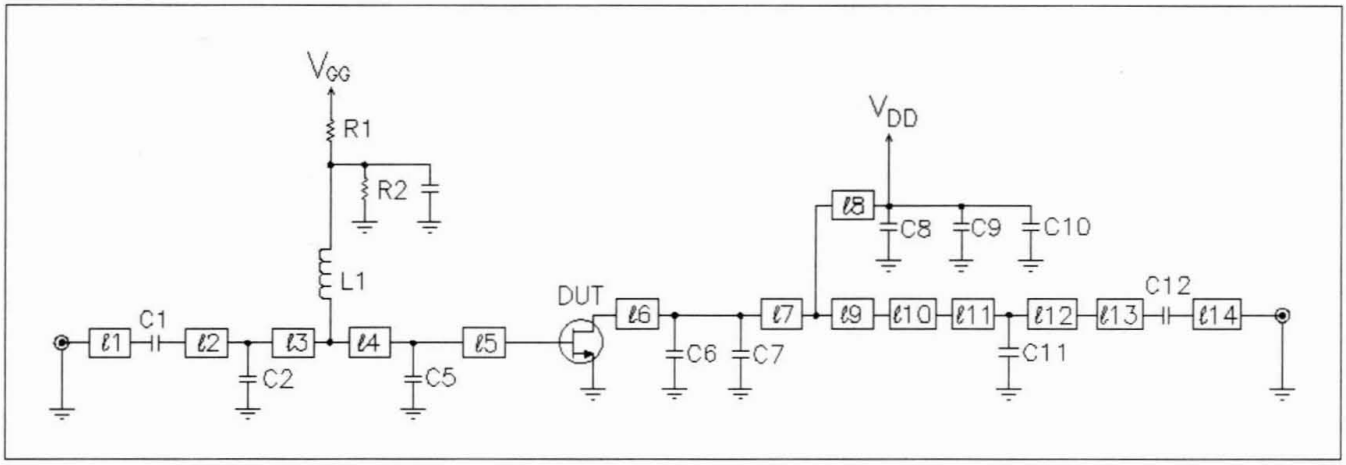
(V_{DD} = 26 V, P_{OUT} = 70 W, I_{DQ} = 700 mA)





Frequency	Z Source Ω		Z Load Ω	
MHz	R	jX	R	jX
920	1.45	-0.64	1.40	1.08
930	1.44	-0.60	1.43	1.06
940	1.43	-0.55	1.45	1.05
950	1.42	-0.34	1.50	1.03
960	1.40	-0.21	1.55	1.02

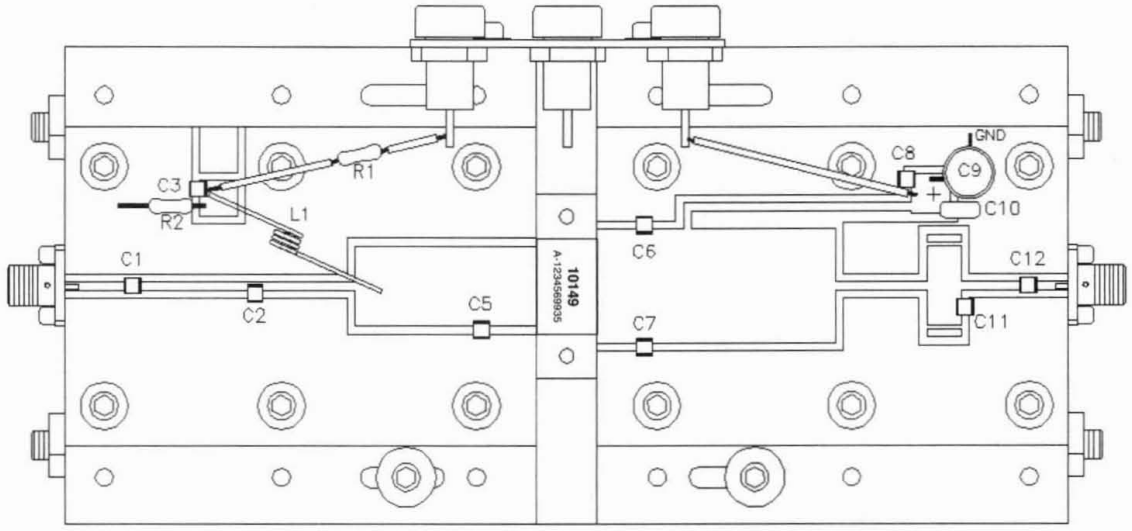
Test Circuit



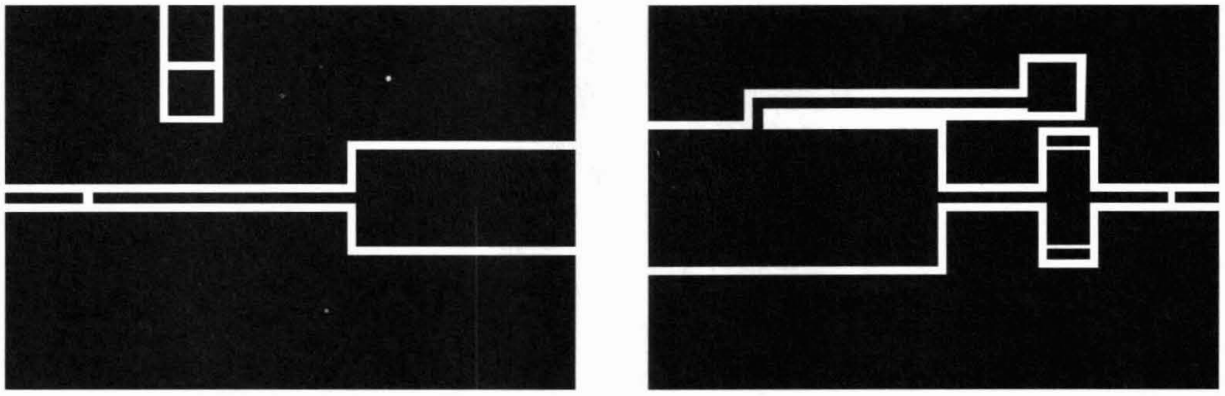
Test Circuit Schematic for f = 960 MHz

DUT	PTF 10149	LDMOS Field Effect Transistor
ℓ1	0.0633 λ 960 GHz	Microstrip 50 Ω
ℓ2	0.1142 λ 960 GHz	Microstrip 50 Ω
ℓ3	0.0821 λ 960 GHz	Microstrip 50 Ω
ℓ4	0.1294 λ 960 GHz	Microstrip 9.18 Ω
ℓ5	0.0468 λ 960 GHz	Microstrip 9.18 Ω
ℓ6	0.0481 λ 960 GHz	Microstrip 6.79 Ω
ℓ7	0.0441 λ 960 GHz	Microstrip 6.79 Ω
ℓ8	0.2500 λ 960 GHz	Microstrip 59 Ω
ℓ9	0.1398 λ 960 GHz	Microstrip 6.79 Ω
ℓ10	0.0821 λ 960 GHz	Microstrip 50 Ω
ℓ11	0.0226 λ 960 GHz	Microstrip 9.69 Ω
ℓ12	0.0109 λ 960 GHz	Microstrip 9.69 Ω
ℓ13	0.0504 λ 960 GHz	Microstrip 50 Ω
ℓ14	0.034 λ 960 GHz	Microstrip 50 Ω

C1, C3, C8, C12	33 pF	Capacitor ATC 100 B
C2	1.3 pF, 50 V	Capacitor, ATC 100 B
C4	Not Used	
C5, C6, C7	7.5 pF	Capacitor, ATC 100 B
C9	100 µF, 50 V	Capacitor, Digi-Key P5182-ND
C10	0.1 υF, 50 V	Capacitor, Digi-Key P4525-ND
C11	0.3 pF	Capacitor ATC 100 B
R1, R2	1K	Resistor, Digi-Key 1KQBK
L1, L2	4 Turn, 20 AWG, .120" I.D.	
Circuit Board	.028" Dielectric Thickness, ε_r = 4.0, AlliedSignal, G200, 2 oz. copper	



Assembly Diagram



Artwork (1 inch)

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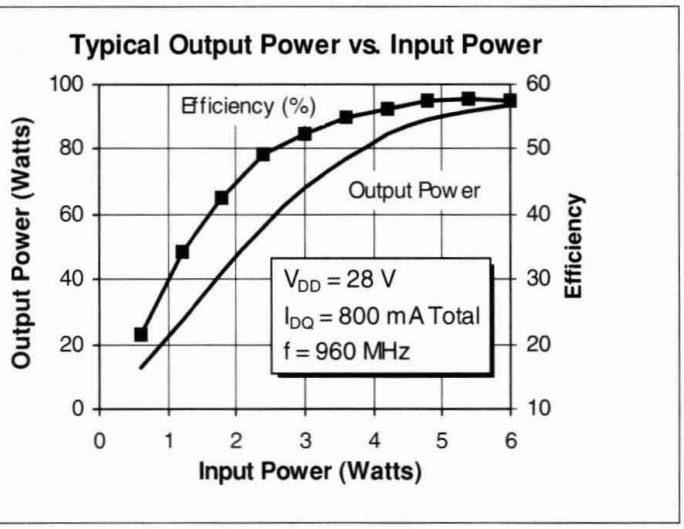
PTF 10036
85 Watts, 860–960 MHz
GOLDMOS™ Field Effect Transistor

Description

The PTF 10036 is an internally matched, 85 Watt LDMOS FET intended for large signal amplifier applications from 860 to 960 MHz. Nitride surface passivation and full gold metallization ensure excellent device lifetime and reliability.

- ***INTERNALLY MATCHED***
- **Performance at 960 MHz, 28 Volts**
  - **Output Power = 85 Watts**
  - **Power Gain = 12.5 dB Typ**
  - **Efficiency = 55% Typ**
- **Full Gold Metallization**
- **Silicon Nitride Passivated**
- **Back Side Common Source**
- **100% Lot Traceability**



Package 20240

RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{DD} = 28 V, P_{OUT} = 85 W, I_{DQ} = 800 mA Total, f = 900 MHz)	G_{ps}	11.0	12.5	—	dB
Power Output at 1 dB Compression (V_{DD} = 28 V, I_{DQ} = 800 mA Total, f = 900 MHz)	P-1dB	85	90	—	Watts
Drain Efficiency (V_{DD} = 28 V, P_{OUT} = 85 W, I_{DQ} = 800 mA Total, f = 900 MHz)	η	50	55	—	%
Load Mismatch Tolerance (V_{DD} = 28 V, P_{OUT} = 85 W(PEP), I_{DQ} = 800 mA Total, f = 867, 867.1 MHz—all phase angles at frequency of test)	Ψ	—	—	3:1	—

All published data at T_{CASE} = 25°C unless otherwise indicated.

ERICSSON

Electrical Characteristics (100% Tested—characteristics, conditions and limits shown per side)

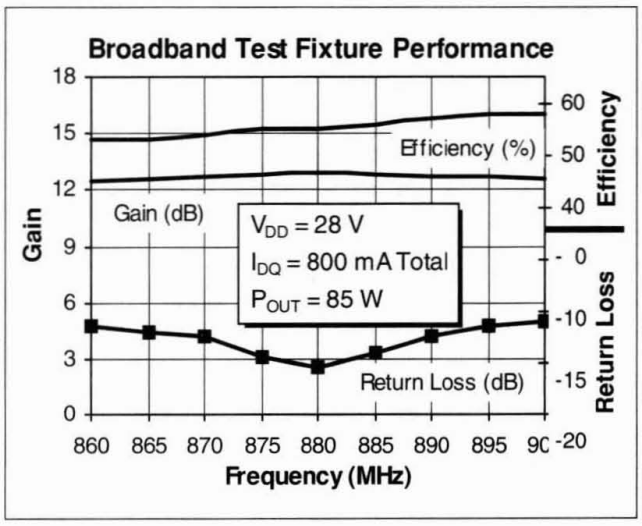
Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 5 mA	$V_{(BR)DSS}$	65	—	—	Volts
Drain-Source Leakage Current	V_{DS} = 28 V, V_{GS} = 0 V	I_{DSS}	—	—	1.0	mA
Gate Threshold Voltage	V_{DS} = 10 V, I_D = 75 mA	$V_{GS(th)}$	3.0	—	5.0	Volts
Forward Transconductance	V_{DS} = 10 V, I_D = 3 A	g_{fs}	—	2.8	—	Siemens

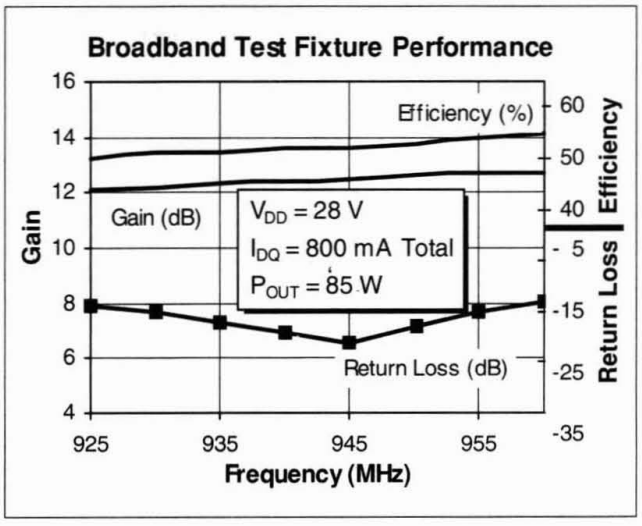
Maximum Ratings

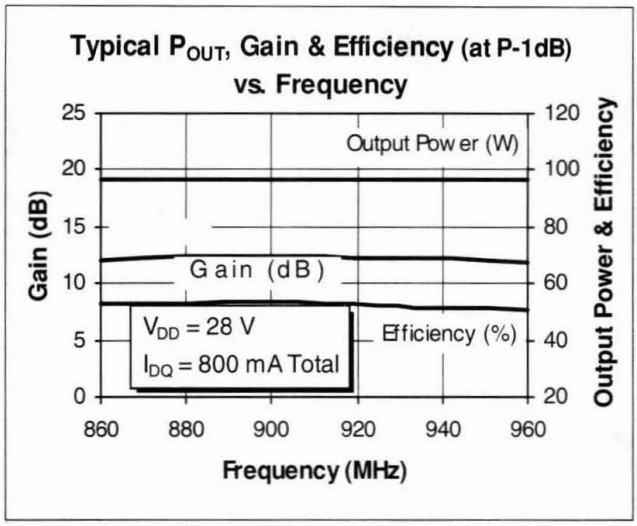
Parameter	Symbol	Value	Unit
Drain-Source Voltage[1]	V_{DSS}	65	Vdc
Gate-Source Voltage[1]	V_{GS}	±20	Vdc
Operating Junction Temperature	T_J	200	°C
Total Device Dissipation at Above 25°C derate by	P_D	250 1.43	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{CASE} = 70°C)	$R_{\theta JC}$	0.7	°C/W

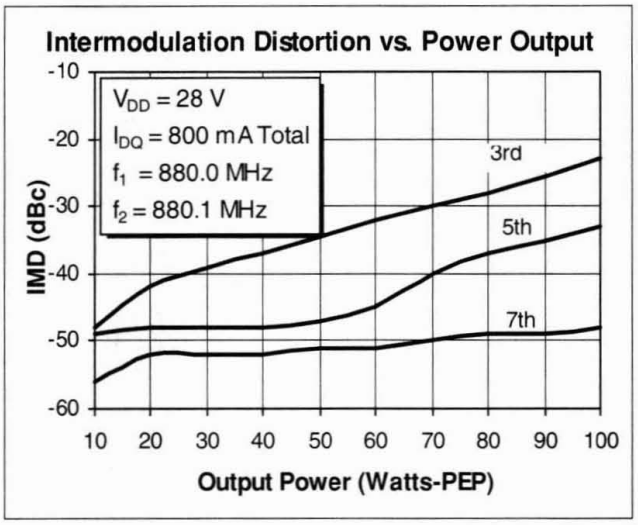
[1] per side

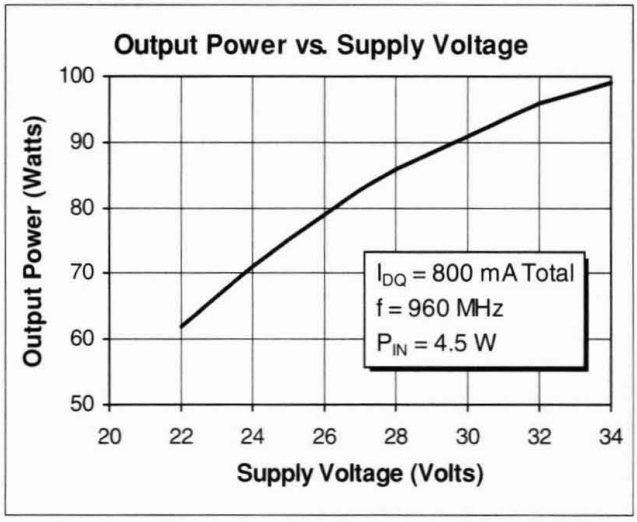
Typical Performance

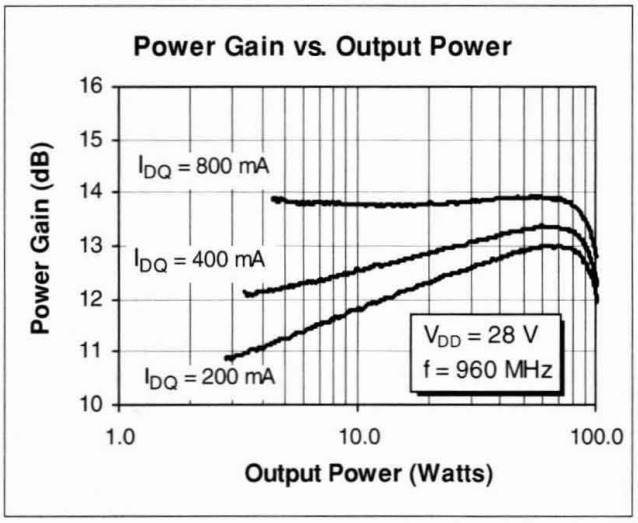


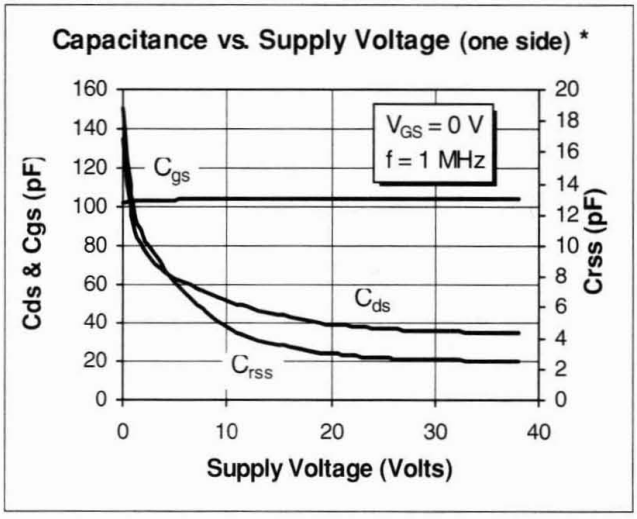


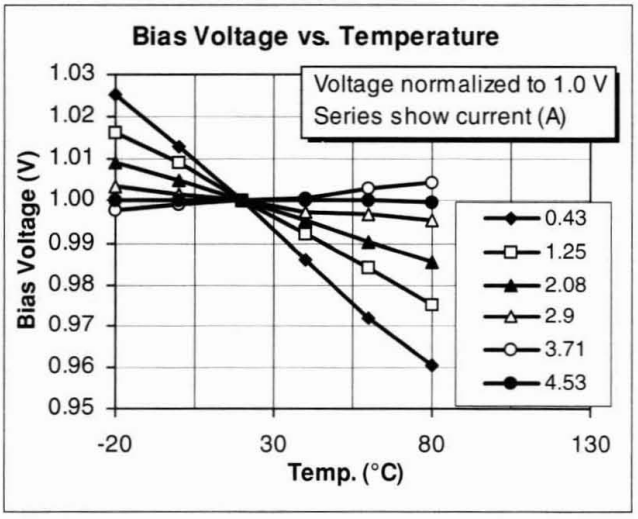








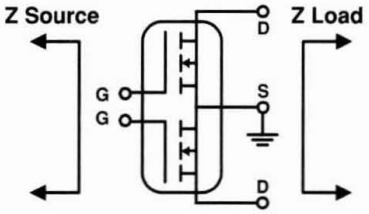


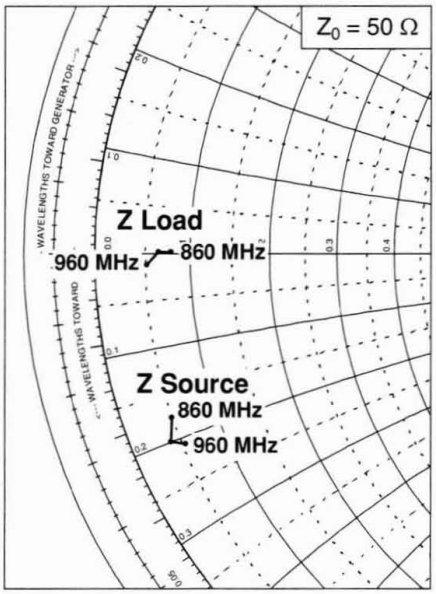


* This part is internally matched. Measurements of the finished product will not yield these results.

Impedance Data

V_{DD} = 28 V, P_{OUT} = 85 W, I_{DQ} = 800 mA Total





Frequency	Z Source Ω		Z Load Ω	
MHz	R	jX	R	jX
860	2.5	-8.8	3.9	0.1
900	2.0	-10.0	3.2	0.1
960	2.7	-10.4	2.6	-0.6

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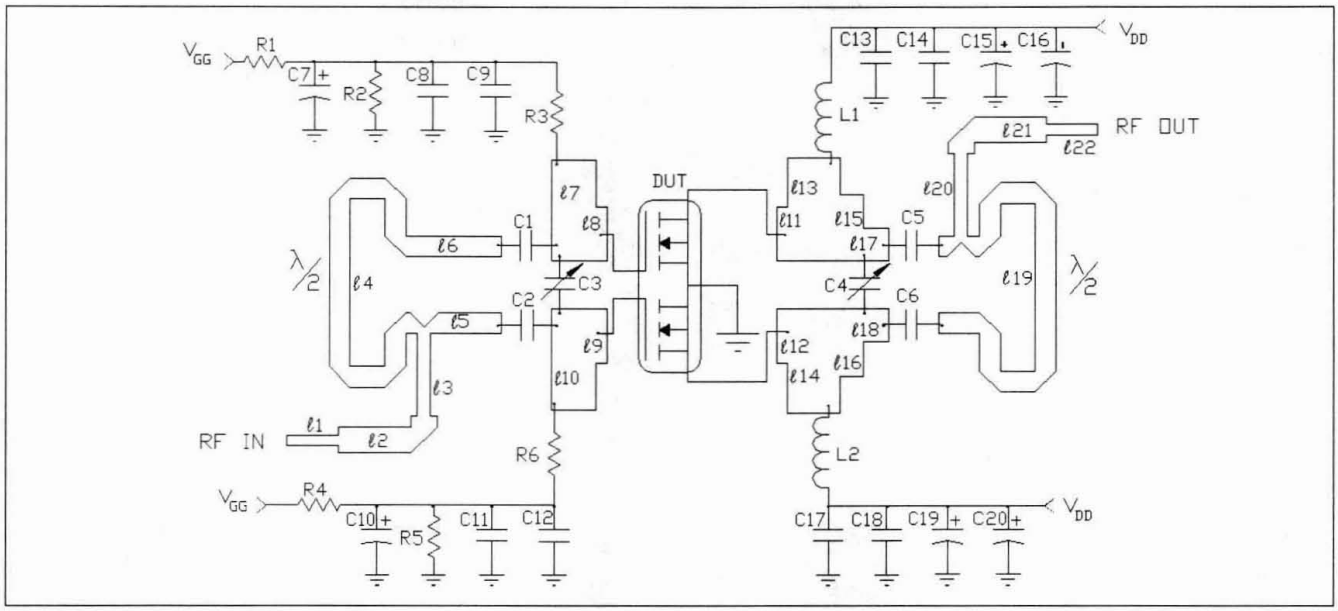
Typical Scattering Parameters (one side only)

(V_{DS} = 28 V, I_D = 1.5 A)

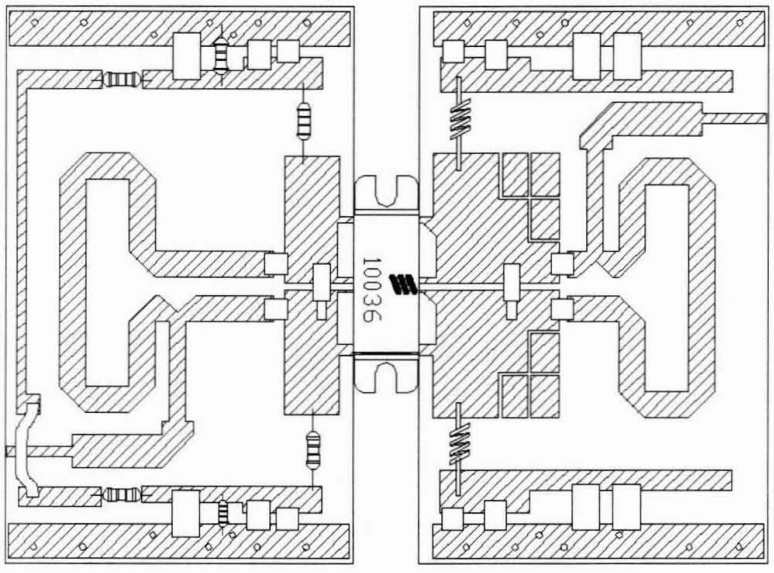
f	S11		S21		S12		S22	
(MHz)	Mag	Ang	Mag	Ang	Mag	Ang	Mag	Ang
100	0.913	-167.7	11.706	62.7	0.008	-21.5	0.605	-126.8
150	0.934	-171.3	6.956	47.4	0.007	-31.1	0.725	-136.6
200	0.950	-173.4	4.507	37.7	0.006	-38.4	0.799	-143.5
250	0.962	-175.0	3.257	29.4	0.005	-43.8	0.873	-148.7
300	0.968	-176.4	2.413	22.8	0.004	-42.4	0.887	-153.0
350	0.971	-177.6	1.905	18.3	0.003	-35.6	0.922	-156.1
400	0.974	-178.6	1.555	13.2	0.002	-30.6	0.943	-158.9
450	0.975	-179.6	1.297	10.4	0.002	-11.8	0.943	-160.6
500	0.976	179.4	1.117	6.5	0.001	7.4	0.961	-162.6
550	0.976	178.4	0.978	3.6	0.002	24.6	0.960	-164.0
600	0.975	177.4	0.881	0.9	0.002	49.2	0.960	-165.1
650	0.975	176.6	0.801	-1.8	0.002	58.7	0.969	-166.6
700	0.972	175.7	0.750	-3.8	0.003	65.0	0.962	-167.1
750	0.971	174.6	0.713	-6.0	0.004	67.9	0.967	-168.3
800	0.968	173.3	0.688	-8.6	0.005	66.2	0.970	-169.0
850	0.968	172.4	0.677	-10.9	0.005	71.8	0.962	-169.4
900	0.962	171.0	0.686	-13.6	0.006	71.3	0.965	-170.5
950	0.956	169.6	0.704	-17.3	0.007	69.6	0.966	-170.8
1000	0.945	167.8	0.750	-21.4	0.008	67.1	0.962	-171.0
1050	0.926	165.7	0.819	-27.7	0.009	64.8	0.961	-171.9
1100	0.887	163.0	0.938	-36.3	0.011	57.6	0.964	-171.6
1150	0.803	160.6	1.128	-51.8	0.013	46.6	0.965	-171.4
1200	0.662	164.4	1.299	-77.1	0.014	27.1	0.981	-171.8
1250	0.659	-178.9	1.183	-109.8	0.012	-0.2	1.006	-172.1
1300	0.803	-174.8	0.856	-136.0	0.007	-16.6	1.008	-173.7
1350	0.897	-177.2	0.587	-151.8	0.004	-14.3	1.004	-175.0
1400	0.938	-179.7	0.416	-161.0	0.002	13.8	1.005	-175.1
1450	0.963	178.1	0.315	-169.1	0.003	50.8	0.996	-176.2
1500	0.977	176.3	0.238	-174.6	0.003	60.3	1.000	-176.4

Test Circuit

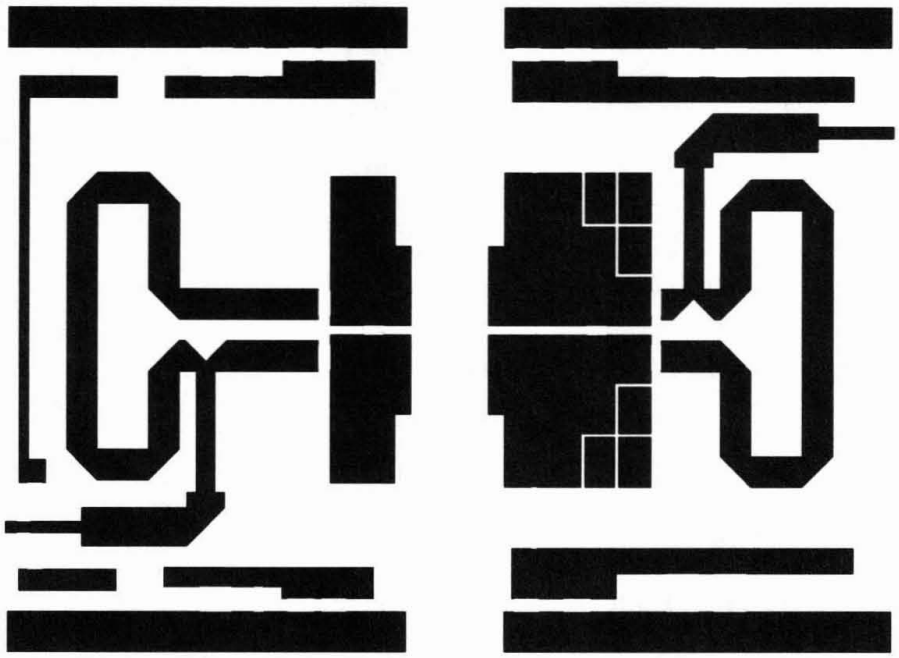


Schematic for f = 900 MHz

DUT	PTF 10036
C1-2	15 pF, Capacitor ATC 100 B
C3	0.35–3.5 pF, Variable Capacitor
C4	1–9 pF, Variable Capacitor
C5-6, C9, C12-13, C17	33 pF, Capacitor ATC 100 B
C7, C10	10 µF, +10 V Electrolytic Capacitor
C8, C11, C14, C18	0.01 µF, Capacitor ATC 100 B
C15, C16, C19, C20	10 µF, +30 V Electrolytic Capacitor
L1. L2	4 Turn, #20 AWG, .120" I.D.
R1, R2, R4, R5	1.0 K, Ω Resistor
R3, R6	5.1 K, 1/4 Ω Resistor
ℓ1, ℓ22	50 Ω, .030 λ
ℓ2, ℓ21	20 Ω, .080 λ
ℓ3, ℓ20	32 Ω, .191 λ
ℓ4, ℓ19	25 Ω, .500 λ
ℓ5, ℓ6	25 Ω, .091 λ
ℓ7, ℓ10	7 Ω, .056 λ
ℓ8, ℓ9	13.0 Ω, .017 λ
ℓ11, ℓ12	13.0 Ω, .017 λ
ℓ13, ℓ14	7.0 Ω, .064 λ
ℓ15, ℓ16	10.0 Ω, .029 λ
ℓ17, ℓ18	19.0 Ω, .028 λ
Circuit Board	.030" Dielectric Thickness, ε_r = 4.0, AlliedSignal, G200, 2 oz. copper



Components Layout (not to scale)



Artwork (1 inch ———)

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Specifications subject to change without notice.
L3
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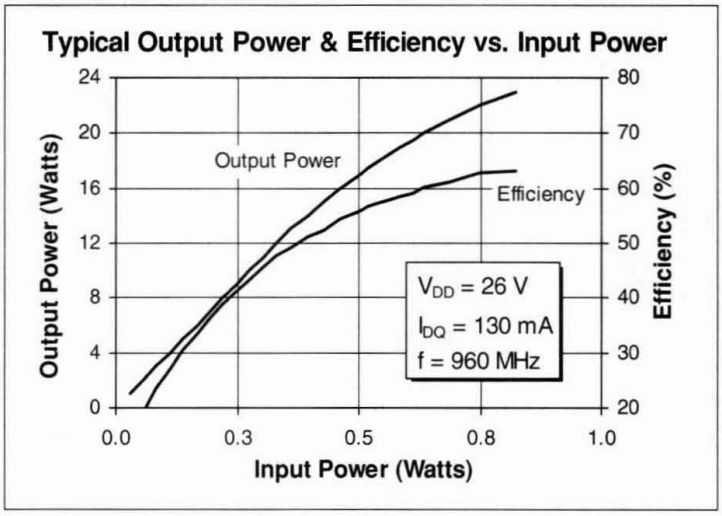
EUS/KR 1301-PTF 10036 Uen Rev. A 02-18-99

PTF 10162
18 Watts, 860–960 MHz
GOLDMOS™ Field Effect Transistor

Description

The PTF 10162 is an 18 Watt LDMOS FET intended for large signal amplifier applications from 860 to 960 MHz. It operates at 55% efficiency with 15 dB of gain. Nitride surface passivation and full gold metallization ensure excellent device lifetime and reliability.

- **Performance at 960 MHz, 26 Volts**
  - **Output Power = 18 Watts**
  - **Power Gain = 15 dB Typ**
  - **Efficiency = 55% Typ**
- **Full Gold Metallization**
- **Silicon Nitride Passivated**
- **Excellent Thermal Stability**
- **Back Side Common Source**
- **100% Lot Traceability**



Package 20222

RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Common Source Power Gain (V_{DD} = 26 V, P_{OUT} = 18 W, I_{DQ} = 130 mA, f = 960 MHz)	G_{ps}	14	15	—	dB
Power Output at 1 dB Compression (V_{DD} = 26 V, I_{DQ} = 130 mA, f = 960 MHz)	P-1dB	18	20	—	Watts
Drain Efficiency (V_{DD} = 26 V, P_{OUT} = 18 W, I_{DQ} = 130 mA, f = 960 MHz)	η	50	55	—	%
Load Mismatch Tolerance (V_{DD} = 26 V, P_{OUT} = 18 W, I_{DQ} = 130 mA, f = 960 MHz— all phase angles at frequency of test)	Ψ	—	—	5:1	—

All published data at T_{CASE} = 25°C unless otherwise indicated.

ERICSSON

PTF 10162

ERICSSON

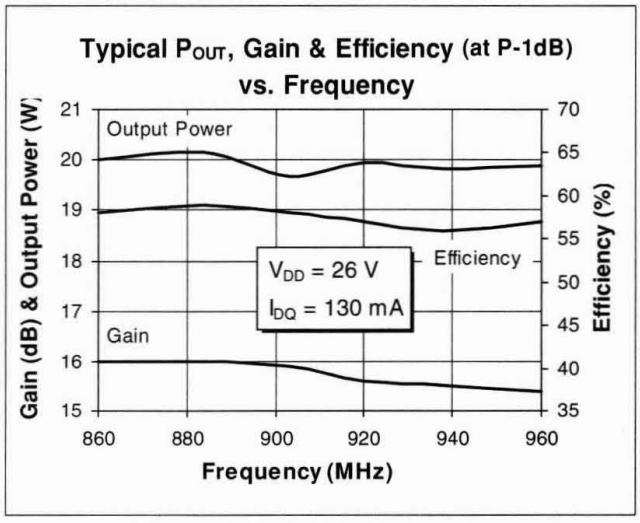
Electrical Characteristics (100% Tested)

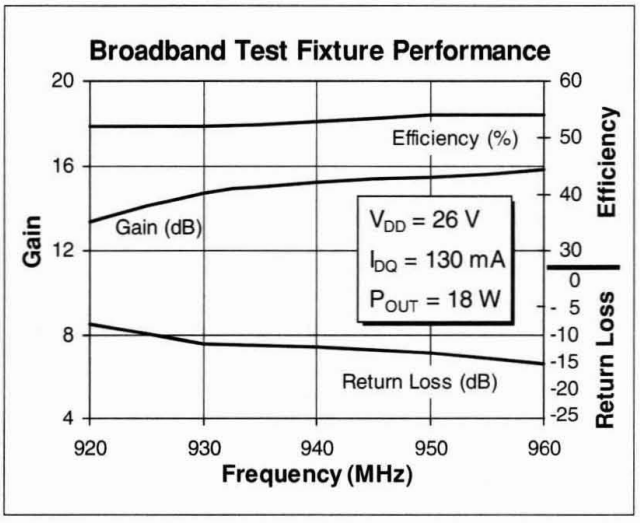
Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 25 mA	$V_{(BR)DSS}$	65	—	—	Volts
Drain-Source Leakage Current	V_{DS} = 28 V, V_{GS} = 0 V	I_{DSS}	—	—	1.0	mA
Gate Threshold Voltage	V_{DS} = 10 V, I_D = 75 mA	$V_{GS(th)}$	3.0	—	5.0	Volts
Forward Transconductance	V_{DS} = 10 V, I_D = 0.5 A	g_{fs}	—	0.9	—	Siemens

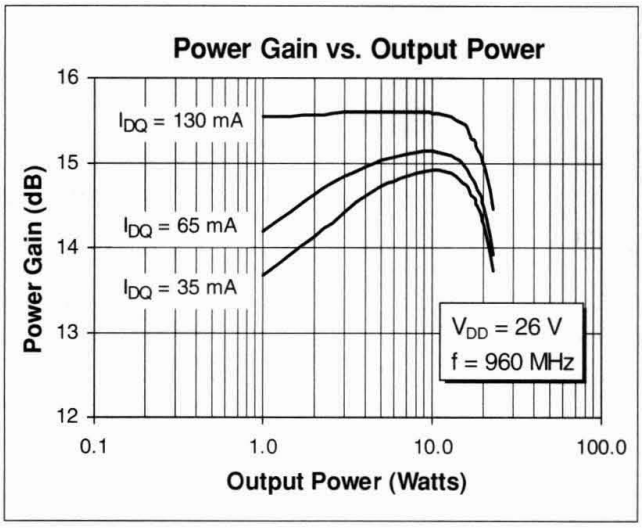
Maximum Ratings

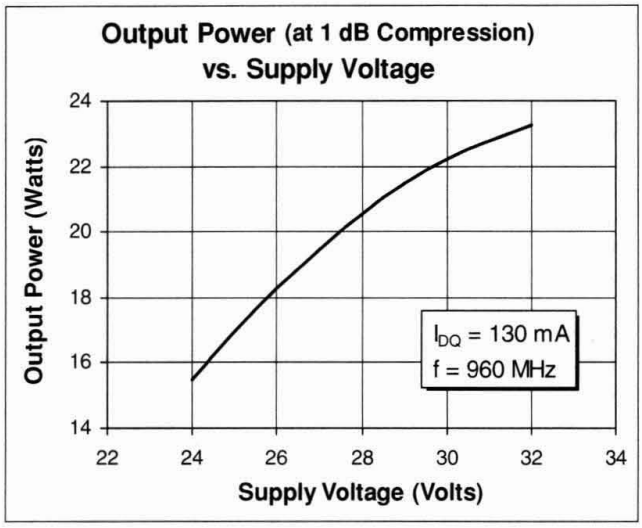
Parameter	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	65	Vdc
Gate-Source Voltage	V_{GS}	±20	Vdc
Operating Junction Temperature	T_J	200	°C
Total Device Dissipation Above 25°C derate by	P_D	58 0.33	Watts W/°C
Storage Temperature	T_{STG}	150	°C
Thermal Resistance (T_{CASE} = 70°C)	$R_{\theta JC}$	3.0	°C/W

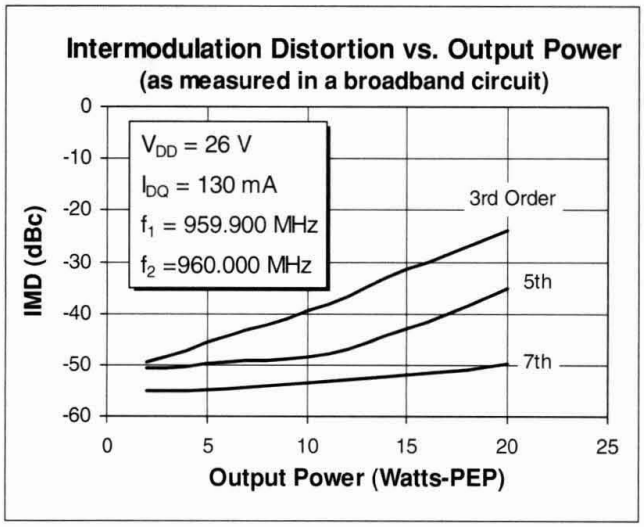
Typical Performance

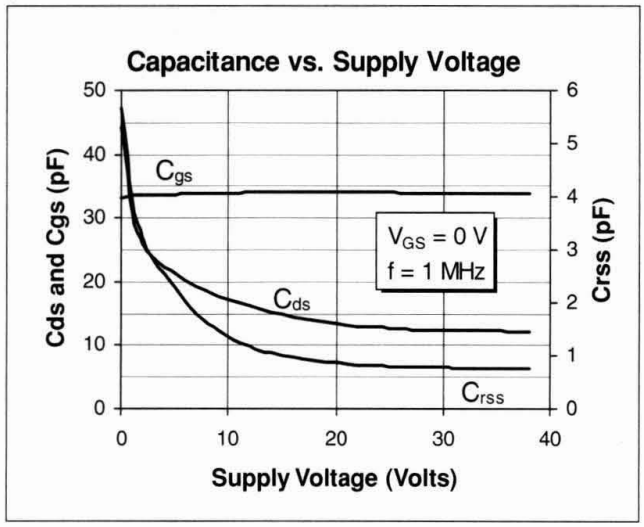


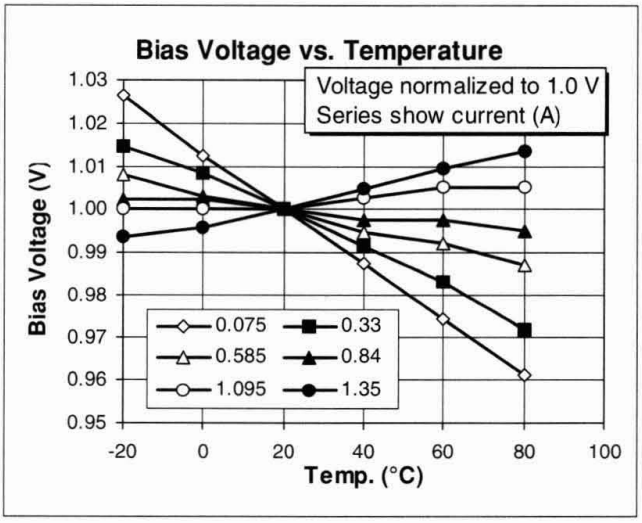



Power Gain vs. Output Power
Power Gain (dB)
Output Power (Watts)
I_{DQ} = 130 mA
I_{DQ} = 65 mA
I_{DQ} = 35 mA
V_{DD} = 26 V
f = 960 MHz
16
15
14
13
12
0.1
1.0
10.0
100.0


Output Power (at 1 dB Compression)
vs. Supply Voltage
Output Power (Watts)
Supply Voltage (Volts)
I_{DQ} = 130 mA
f = 960 MHz
24
22
20
18
16
14
22
24
26
28
30
32
34

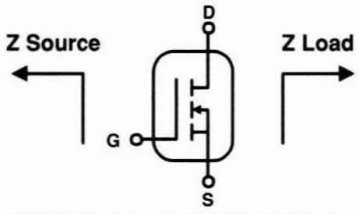

Intermodulation Distortion vs. Output Power
(as measured in a broadband circuit)
IMD (dBc)
Output Power (Watts-PEP)
V_{DD} = 26 V
I_{DQ} = 130 mA
f_1 = 959.900 MHz
f_2 =960.000 MHz
3rd Order
5th
7th
0
-10
-20
-30
-40
-50
-60
0
5
10
15
20
25


Capacitance vs. Supply Voltage
Cds and Cgs (pF)
Crss (pF)
Supply Voltage (Volts)
C_{gs}
C_{ds}
C_{rss}
V_{GS} = 0 V
f = 1 MHz
50
40
30
20
10
0
6
5
4
3
2
1
0
0
10
20
30
40

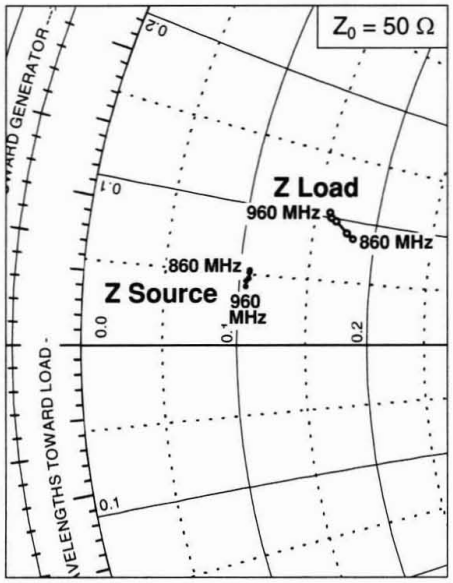

Bias Voltage vs. Temperature
Voltage normalized to 1.0 V
Series show current (A)
Bias Voltage (V)
Temp. (°C)
0.075
0.33
0.585
0.84
1.095
1.35
1.03
1.02
1.01
1.00
0.99
0.98
0.97
0.96
0.95
-20
0
20
40
60
80
100

Impedance Data

V_{DD} = 26 V, P_{OUT} = 18 W, I_{DQ} = 130 mA



Frequency	Z Source Ω		Z Load Ω	
MHz	R	jX	R	jX
860	2.0	2.7	5.8	4.4
880	2.0	2.6	5.5	4.6
900	2.0	2.4	5.0	5.0
920	1.9	2.3	4.8	5.1
960	1.9	2.1	4.7	5.3



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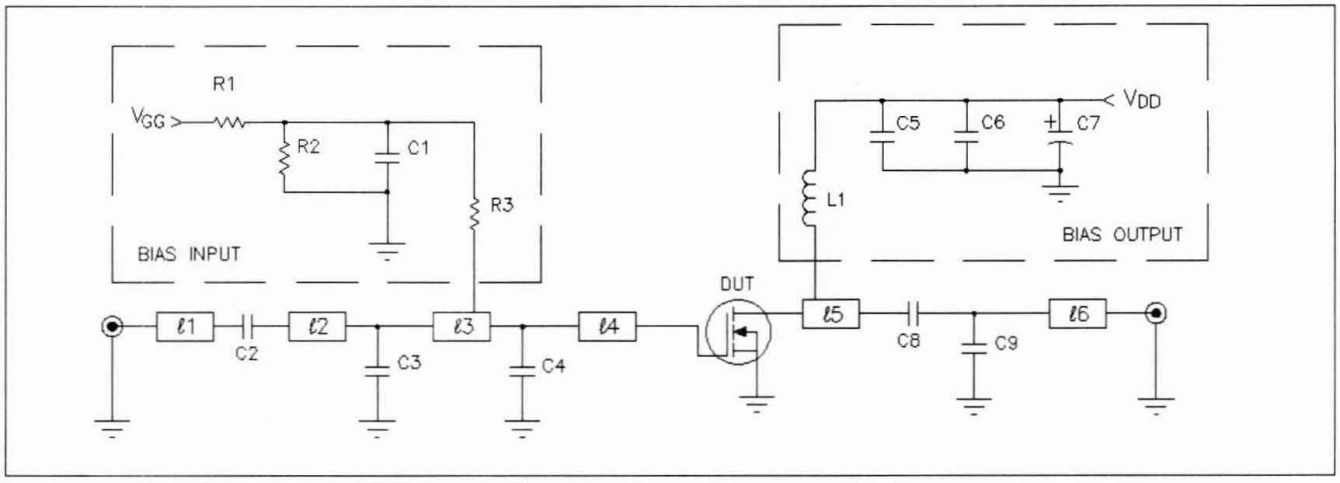
Typical Scattering Parameters

(V_{DS} = 26 V, I_D = 500 mA)

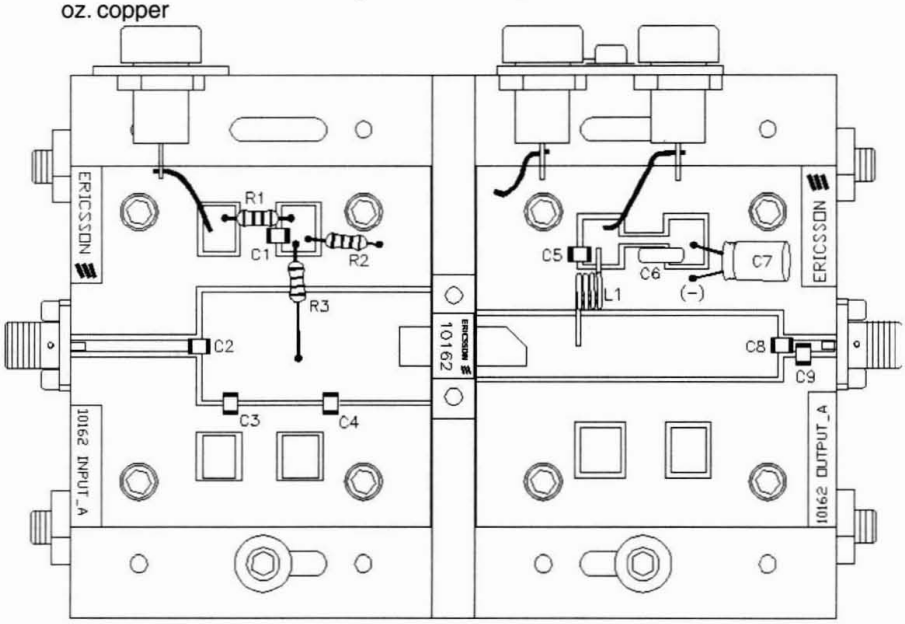
f	S11		S21		S12		S22	
(MHz)	Mag	Ang	Mag	Ang	Mag	Ang	Mag	Ang
100	0.828	-120	27.9	103	0.015	20.6	0.597	-65.9
150	0.821	-138	19.2	87.8	0.014	10.7	0.576	-79.6
200	0.817	-148	14.1	77.5	0.013	6.0	0.571	-91.7
250	0.825	-155	10.8	69.6	0.011	6.5	0.602	-102
300	0.836	-160	8.75	62.7	0.009	9.7	0.628	-110
350	0.847	-164	7.09	56.4	0.007	20.7	0.661	-118
400	0.859	-167	5.96	51.3	0.006	41.5	0.698	-124
450	0.870	-170	5.02	45.6	0.007	64.2	0.723	-130
500	0.883	-172	4.31	42.2	0.008	83.2	0.754	-135
550	0.892	-174	3.71	36.9	0.011	92.6	0.783	-140
600	0.902	-176	3.20	33.3	0.014	97.9	0.805	-144
650	0.909	-179	2.81	29.6	0.016	98.5	0.831	-149
700	0.919	180	2.48	26.7	0.020	98.6	0.845	-152
750	0.922	178	2.19	23.6	0.022	98.7	0.860	-155
800	0.930	176	1.97	21.1	0.025	99.3	0.880	-158
850	0.934	174	1.77	17.5	0.028	98.6	0.890	-161
900	0.941	173	1.61	16.3	0.032	98.3	0.904	-164
950	0.943	171	1.47	12.5	0.035	95.8	0.916	-166
1000	0.944	170	1.31	10.8	0.039	95.4	0.922	-168
1050	0.946	169	1.21	8.51	0.043	92.5	0.930	-171
1100	0.950	167	1.12	5.94	0.046	91.7	0.937	-172
1150	0.950	166	1.02	3.97	0.049	91.4	0.945	-174
1200	0.952	164	0.952	4.03	0.053	90.5	0.945	-176
1250	0.952	163	0.902	0.16	0.057	87.1	0.955	-178
1300	0.952	162	0.805	-0.92	0.060	87.6	0.951	-180
1350	0.953	160	0.781	-1.19	0.065	86.6	0.958	178
1400	0.956	159	0.732	-5.01	0.068	84.9	0.955	177
1450	0.954	157	0.688	-5.67	0.072	84.9	0.963	175
1500	0.952	156	0.660	-6.40	0.078	84.2	0.953	173
1550	0.952	154	0.619	-6.60	0.084	83.9	0.967	172
1600	0.949	153	0.573	-7.30	0.085	83.7	0.950	170
1650	0.948	151	0.591	-7.58	0.097	83.1	0.959	169
1700	0.947	150	0.523	-7.59	0.096	82.2	0.950	167
1750	0.946	148	0.492	-7.59	0.106	81.6	0.949	166
1800	0.945	147	0.498	-7.60	0.113	81.4	0.953	163
1850	0.943	145	0.453	-7.64	0.119	80.9	0.952	163
1900	0.942	143	0.442	-6.40	0.124	79.8	0.947	160
1950	0.945	142	0.433	-6.23	0.134	79.6	0.957	159
2000	0.947	140	0.406	-6.20	0.135	79.5	0.953	157
2050	0.949	139	0.401	-5.74	0.150	80.1	0.946	156
2100	0.951	137	0.392	-5.20	0.154	79.4	0.955	153
2150	0.952	136	0.376	-4.36	0.171	79.0	0.950	153
2200	0.956	134	0.357	-4.30	0.171	76.1	0.949	150

Test Circuit



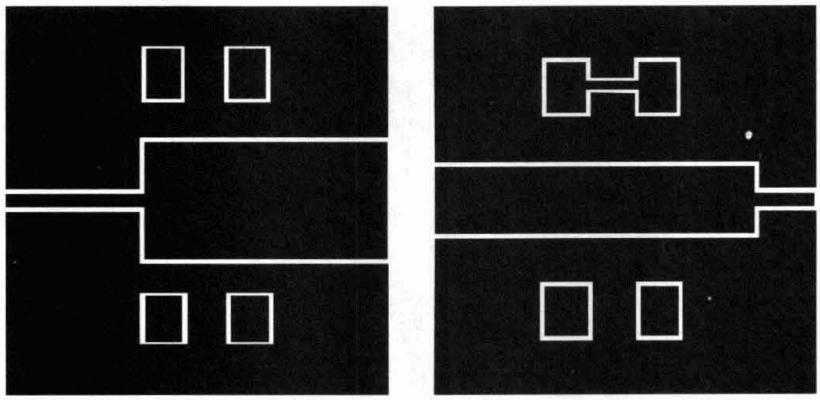
Test Circuit Schematic for f = 960 MHz

DUT	PTF 10162	
$\ell 1$	Microstrip 50 Ω (0.098 λ, 960 MHz)	
$\ell 2$	Microstrip 8.4 Ω (0.025 λ, 960 MHz)	
$\ell 3$, $\ell 4$	Microstrip 8.4 Ω (0.084 λ, 960 MHz)	
$\ell 5$	Microstrip 13.9 Ω (0.256 λ, 960 MHz)	
$\ell 6$	Microstrip 50 Ω (0.040 λ, 960 MHz)	
C1, C2, C5, C8	Capacitor, 36 pF	ATC 100 B
C3	Capacitor, 3.0 pF	ATC 100 B
C4	Capacitor, 3.6 pF	ATC 100 B
C6	Capacitor, 0.1 µF, 50 V	Digi-Key P4525-ND
C7	Capacitor, 100 µF, 50 V	Digi-Key P5182-ND
C9	Capacitor, 0.7pF	ATC 100 B
L1	4 Turns, 20 AWG, .120 I.D.	N/A
R1, R2, R3	Resistor, 220 W	Digi-Key 2.2 QBK
Circuit Board	.028" Dielectric Thickness, ε_r = 4.0, AlliedSignal, G200, 2 oz. copper	



Placement Diagram (not to scale)

Test Circuit (Check our Web site at www.ericsson.com/rfpower for Gerber files for this circuit.)



Artwork (1 inch ——— *).*

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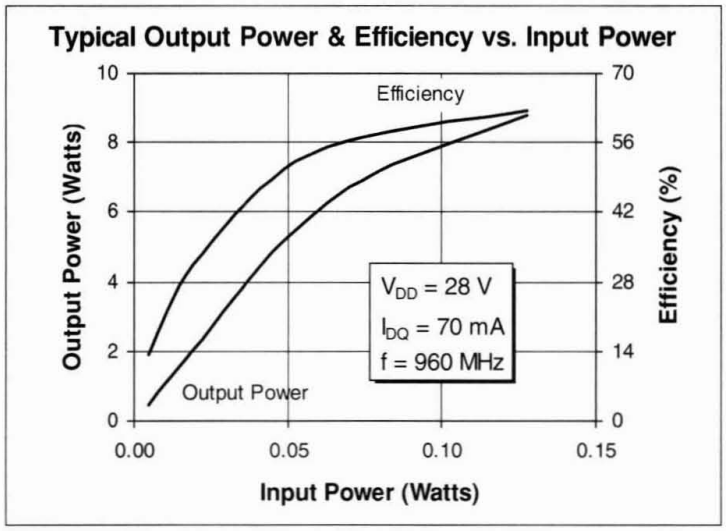
PTF 10136
6 Watts, 1.0 GHz
GOLDMOS™ Field Effect Transistor

Description

The PTF 10136 is a 6 Watt LDMOS FET intended for large signal amplifier applications to 1.0 GHz. It operates at 57% efficiency with 19 dB of gain. Nitride surface passivation and full gold metallization ensure excellent device lifetime and reliability.

- **Performance at 960 MHz, 28 Volts**
  - **Output Power = 6 Watts**
  - **Efficiency = 57% Typ**
  - **Power Gain = 19 dB Typ**
- **Full Gold Metallization**
- **Silicon Nitride Passivated**
- **Surface Mountable**
- **Available in Tape and Reel**
- **100% Lot Traceability**



Package 20244

RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Common Source Power Gain (V_{DD} = 28 V, P_{OUT} = 1 W, I_{DQ} = 70 mA, f = 960 MHz)	G_{ps}	18	19	—	dB
Power Output at 1 dB Compressed (V_{DD} = 28 V, I_{DQ} = 70 mA, f = 960 MHz)	P-1dB	6.0	7.5	—	Watts
Drain Efficiency (V_{DD} = 28 V, P_{OUT} = 6 W, I_{DQ} = 70 mA, f = 960 MHz)	η	50	57	—	%
Load Mismatch Tolerance (V_{DD} = 28 V, P_{OUT} = 6 W, I_{DQ} = 70 mA, f = 960 MHz— all phase angles at frequency of test)	Ψ	—	—	10:1	—

All published data at T_{CASE} = 25°C unless otherwise indicated.

ERICSSON

PTF 10136

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Electrical Characteristics (100% Tested)

Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 25 mA	$V_{(BR)DSS}$	65	—	—	Volts
Drain-Source Leakage Current	V_{DS} = 28 V, V_{GS} = 0 V	I_{DSS}	—	—	1	mA
Gate Threshold Voltage	V_{DS} = 10 V, I_D = 75 mA	$V_{GS(th)}$	3.0	—	5.0	Volts
Forward Transconductance	V_{DS} = 10 V, I_D = 0.5 A	g_{fs}	—	0.3	—	Siemens

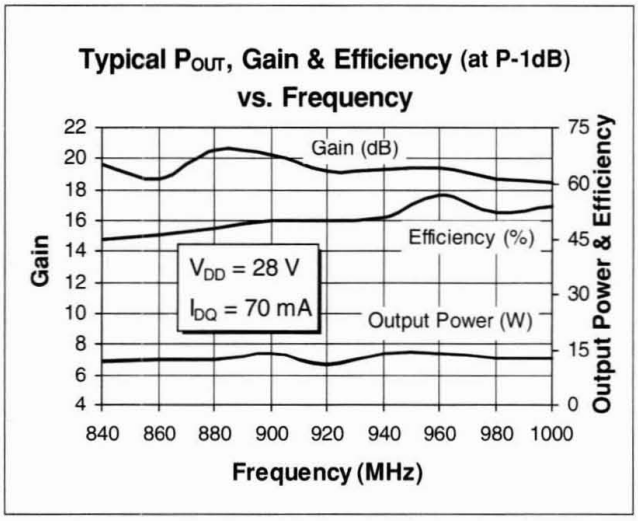
Maximum Ratings

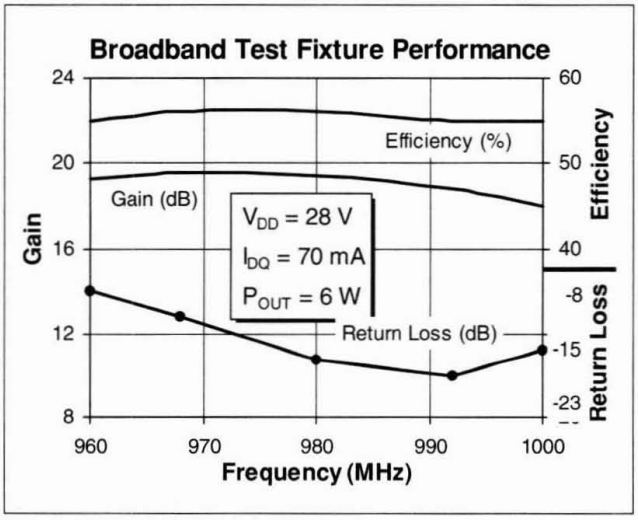
Parameter	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	65	Vdc
Gate-Source Voltage	V_{GS}	±20	Vdc
Operating Junction Temperature	T_J	200	°C
Total Device Dissipation Above 25°C derate by	P_D	39 0.22	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{CASE} = 70°C)	$R_{\theta JC}$	4.5	°C/W

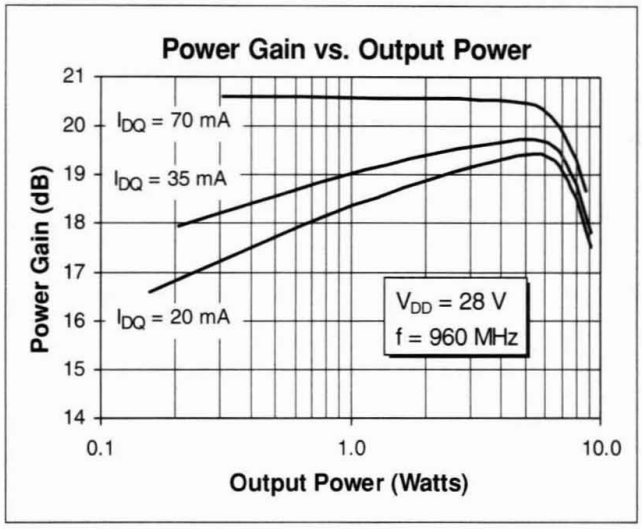
GOLDMOS™

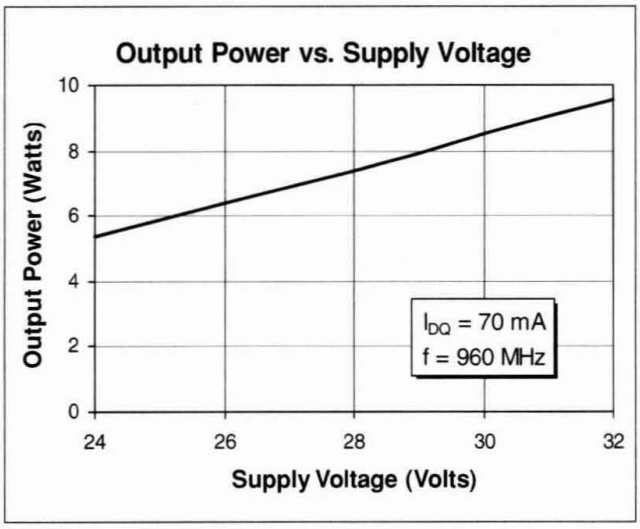
3

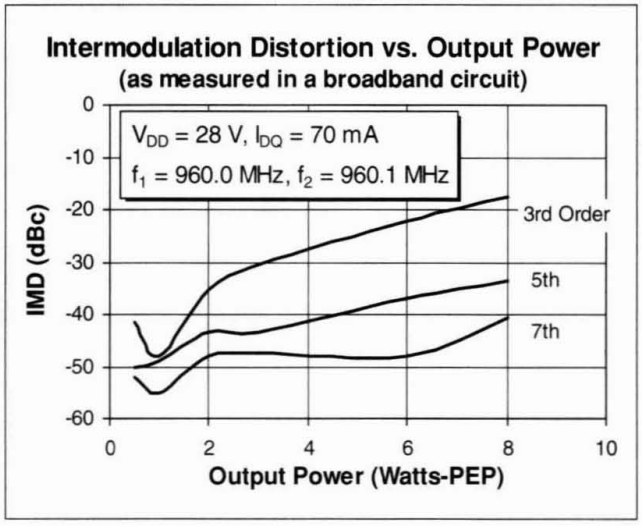
Typical Performance

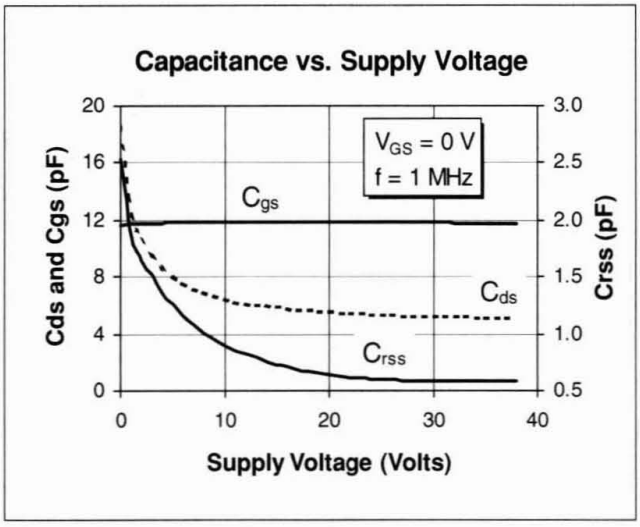


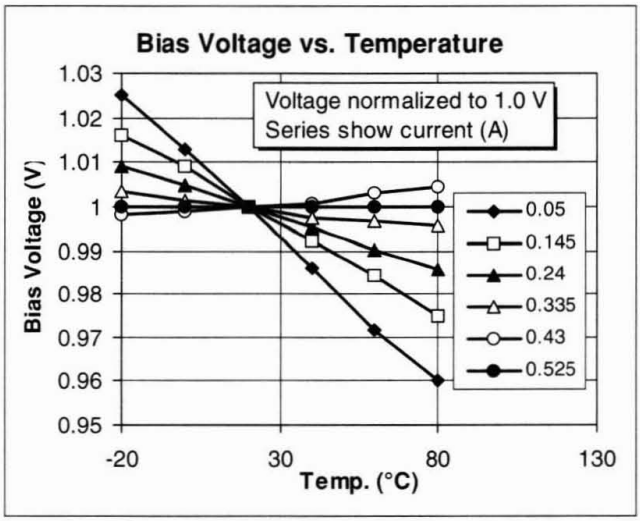



Power Gain vs. Output Power
Power Gain (dB)
21
20
19
18
17
16
15
14
I_{DQ} = 70 mA
I_{DQ} = 35 mA
I_{DQ} = 20 mA
V_{DD} = 28 V
f = 960 MHz
0.1
1.0
10.0
Output Power (Watts)


Output Power vs. Supply Voltage
Output Power (Watts)
10
8
6
4
2
0
I_{DQ} = 70 mA
f = 960 MHz
24
26
28
30
32
Supply Voltage (Volts)

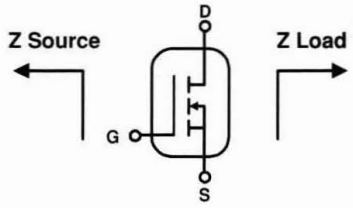

Intermodulation Distortion vs. Output Power
(as measured in a broadband circuit)
IMD (dBc)
0
-10
-20
-30
-40
-50
-60
V_{DD} = 28 V, I_{DQ} = 70 mA
f_1 = 960.0 MHz, f_2 = 960.1 MHz
3rd Order
5th
7th
0
2
4
6
8
10
Output Power (Watts-PEP)


Capacitance vs. Supply Voltage
Cds and Cgs (pF)
20
16
12
8
4
0
Crss (pF)
3.0
2.5
2.0
1.5
1.0
0.5
V_{GS} = 0 V
f = 1 MHz
C_{gs}
C_{ds}
C_{rss}
0
10
20
30
40
Supply Voltage (Volts)

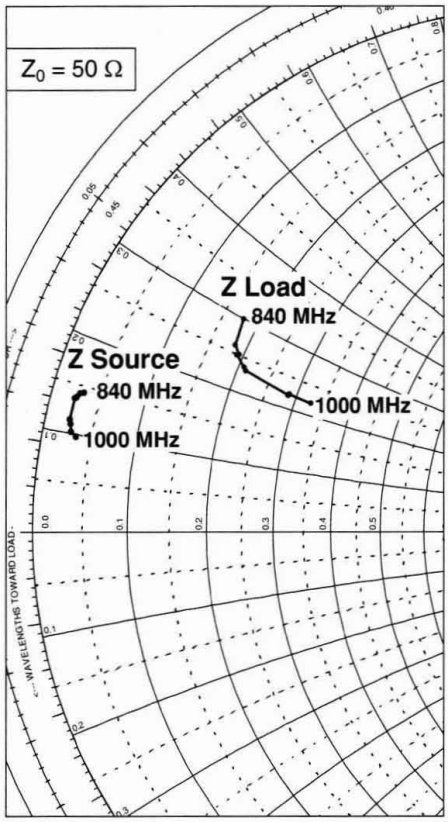

Bias Voltage vs. Temperature
Bias Voltage (V)
1.03
1.02
1.01
1
0.99
0.98
0.97
0.96
0.95
Voltage normalized to 1.0 V
Series show current (A)
0.05
0.145
0.24
0.335
0.43
0.525
-20
30
80
130
Temp. (°C)

Impedance Data

V_{DD} = 28 V, I_{DQ} = 70 mA, P-1dB = 6 W



Frequency	Z Source Ω		Z Load Ω	
MHz	R	jX	R	jX
840	1.6	7.2	8.9	15.0
860	1.4	7.1	9.2	13.1
880	1.4	7.1	9.7	12.6
900	1.3	6.9	9.6	12.5
920	1.2	6.8	10.4	11.9
940	1.2	5.7	10.6	11.7
960	1.3	5.5	14.3	11.1
980	1.4	5.1	14.4	11.2
1000	1.7	4.9	16.3	11.1

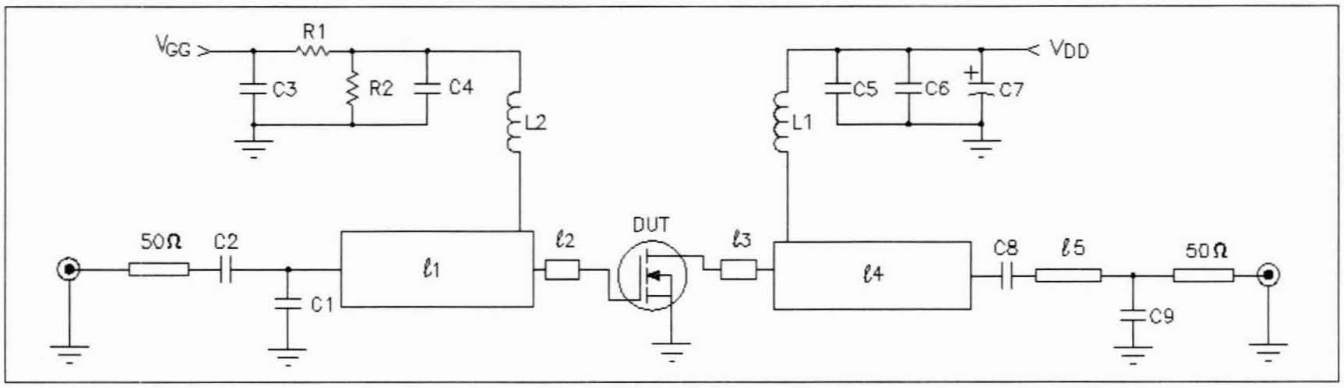


Typical Scattering Parameters

(V_{DS} = 28 V, I_D = 200 mA)

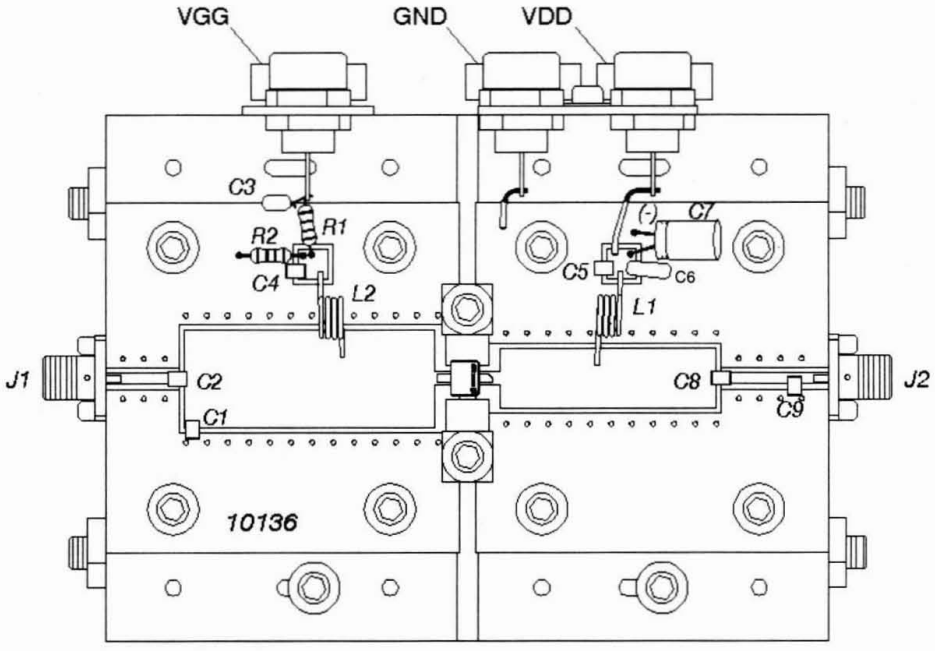
f	S11		S21		S12		S22	
(MHz)	Mag	Ang	Mag	Ang	Mag	Ang	Mag	Ang
100	0.962	-65.3	22.2	138	0.016	48.1	0.888	-31.8
150	0.925	-78.2	20.0	129	0.018	39.0	0.853	-37.7
200	0.918	-95.7	17.4	116	0.021	28.5	0.810	-46.7
250	0.913	-109	15.0	106	0.022	19.7	0.776	-54.3
300	0.906	-120	13.0	96.8	0.023	12.4	0.754	-61.2
350	0.900	-128	11.4	89.2	0.023	6.10	0.742	-67.1
400	0.896	-134	9.98	82.5	0.022	0.77	0.737	-72.9
450	0.894	-140	8.84	76.4	0.022	-3.81	0.735	-78.3
500	0.895	-144	7.90	70.9	0.021	-7.93	0.739	-83.4
550	0.896	-148	7.09	65.9	0.020	-11.6	0.743	-88.4
600	0.897	-152	6.41	61.1	0.019	-15.0	0.752	-93.2
650	0.901	-155	5.85	56.9	0.018	-17.5	0.763	-97.5
700	0.900	-158	5.33	52.7	0.017	-19.8	0.771	-102
750	0.905	-160	4.89	48.7	0.015	-21.4	0.782	-106
800	0.908	-162	4.49	45.0	0.014	-22.9	0.787	-110
850	0.910	-165	4.14	41.2	0.013	-24.2	0.797	-113
900	0.917	-167	3.85	37.8	0.012	-24.3	0.808	-117
950	0.916	-169	3.56	34.6	0.011	-24.3	0.817	-120
1000	0.919	-171	3.31	31.2	0.009	-22.7	0.828	-123
1050	0.923	-172	3.09	28.4	0.008	-20.5	0.833	-126
1100	0.925	-174	2.88	25.2	0.007	-16.5	0.841	-129
1150	0.932	-176	2.70	22.4	0.006	-10.7	0.849	-132
1200	0.929	-177	2.53	19.7	0.006	-1.76	0.855	-135
1250	0.930	-179	2.38	16.8	0.005	9.41	0.864	-138
1300	0.934	180	2.24	14.5	0.005	22.3	0.871	-140
1350	0.935	178	2.10	11.9	0.005	33.2	0.875	-142
1400	0.943	177	2.00	9.38	0.005	43.6	0.883	-145
1450	0.942	176	1.89	7.16	0.006	52.3	0.883	-147
1500	0.942	174	1.80	4.51	0.007	59.0	0.891	-149
1550	0.946	173	1.71	2.46	0.008	64.1	0.897	-151
1600	0.943	171	1.62	-0.02	0.009	67.2	0.902	-153
1650	0.951	170	1.55	-2.40	0.010	69.7	0.911	-155
1700	0.951	169	1.48	-4.21	0.011	71.9	0.911	-157
1750	0.951	167	1.41	-6.51	0.012	72.2	0.911	-159
1800	0.952	166	1.35	-8.48	0.013	72.5	0.912	-161
1850	0.947	165	1.28	-10.8	0.014	72.0	0.911	-163
1900	0.951	163	1.24	-13.0	0.015	71.8	0.920	-165
1950	0.951	162	1.18	-14.7	0.017	71.9	0.920	-166
2000	0.949	161	1.13	-16.8	0.018	71.3	0.923	-168
2050	0.953	160	1.09	-18.7	0.019	71.1	0.925	-170
2100	0.947	159	1.05	-20.8	0.020	70.4	0.922	-171
2150	0.950	157	1.01	-22.9	0.021	69.4	0.929	-173
2200	0.946	156	0.982	-24.2	0.022	68.6	0.930	-175

Test Circuit

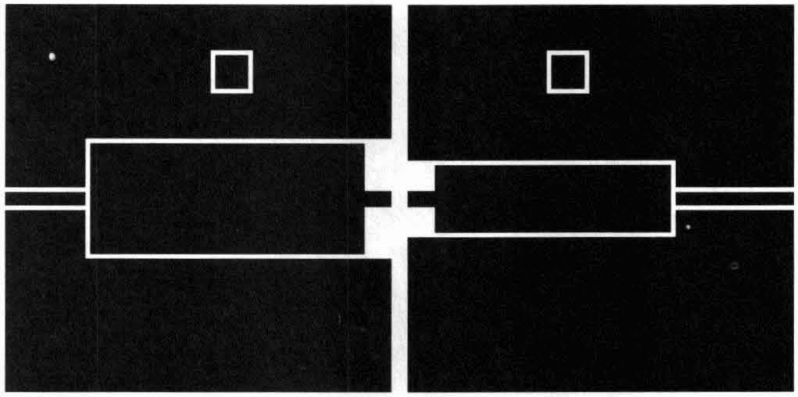


Test Circuit Schematic for f = 960 MHz

DUT	PTF 10136	LDMOS Transistor
ℓ1	0.225 λ 960 MHz	Microstrip 8.9 Ω
ℓ2, ℓ3	0.018 λ 960 MHz	Microstrip 44 Ω
ℓ4	0.184 λ 960 MHz	Microstrip 14.1 Ω
ℓ5	0.100 λ 960 MHz	Microstrip 50 Ω
C1	1.1 pF, Capacitor ATC B	
C2, C4, C5, C8	51 pF, Capacitor ATC 100 B	
C3, C6	0.1 µF, 50 V, Capacitor, Digi-Key P4525-ND	
C7	100 µF, 50 V, Electrolytic Capacitor, Digi-Key P5782-ND	
C9	5.1 pF, Capacitor ATC 100 B	
L1, L2	4 Turn, #22 AWG, .085" I.D.	
R1, R2	220 Ω, 1/4 W Resistor	
Circuit Board	.028" Dielectric Thickness, ε_r = 4.0, AlliedSignal, G200, 2 oz. copper	



Placement Diagram (not to scale)



Artwork (1 inch ———)

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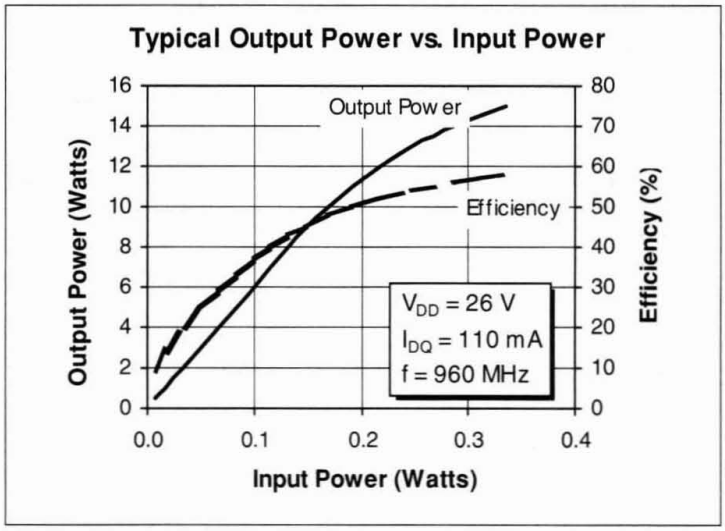
PTF 10147
10 Watts, 1.0 GHz
GOLDMOS™ Field Effect Transistor

Description

The PTF 10147 is a 10 Watt LDMOS FET intended for large signal amplifier applications to 1.0 GHz. It operates at 58% efficiency and 16.5 dB of gain. Nitride surface passivation and full gold metallization ensure excellent device lifetime and reliability.

- **Performance at 960 MHz, 26 Volts**
  - **Output Power = 10 Watts**
  - **Efficiency = 58% Typ**
  - **Power Gain = 16.5 dB Typ**
- **Full Gold Metallization**
- **Silicon Nitride Passivated**
- **Surface Mountable**
- **Available in Tape and Reel**
- **100% Lot Traceability**



Package 20244

RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Common Source Power Gain (V_{DD} = 26 V, P_{OUT} = 10 W, I_{DQ} = 110 mA, f = 960 MHz)	G_{ps}	15.0	16.5	—	dB
Power Output at 1 dB Compressed (V_{DD} = 26 V, I_{DQ} = 110 mA, f = 960 MHz)	P-1dB	10	12	—	Watts
Drain Efficiency (V_{DD} = 26 V, P_{OUT} = 10 W, I_{DQ} = 110 mA, f = 960 MHz)	η	50	58	—	%
Load Mismatch Tolerance (V_{DD} = 26 V, P_{OUT} = 10 W, I_{DQ} = 110 mA, f = 960 MHz— all phase angles at frequency of test)	Ψ	—	—	10:1	—

All published data at T_{CASE} = 25°C unless otherwise indicated.

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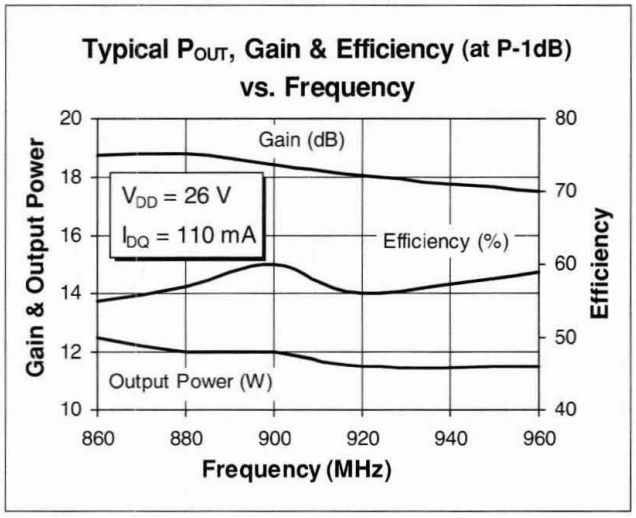
Electrical Characteristics (100% Tested)

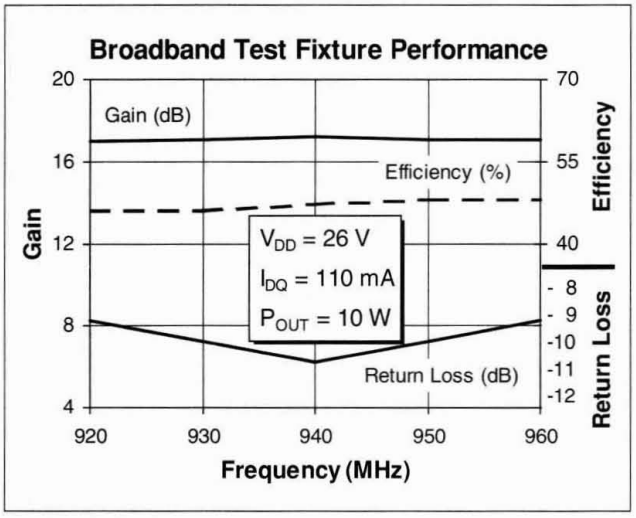
Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 25 mA	$V_{(BR)DSS}$	65	70	—	Volts
Drain-Source Leakage Current	V_{DS} = 28 V, V_{GS} = 0 V	I_{DSS}	—	—	1	mA
Gate Threshold Voltage	V_{DS} = 10 V, I_D = 75 mA	$V_{GS(th)}$	3	—	5	Volts
Forward Transconductance	V_{DS} = 10 V, I_D = 0.5 A	g_{fs}	—	0.6	—	Siemens

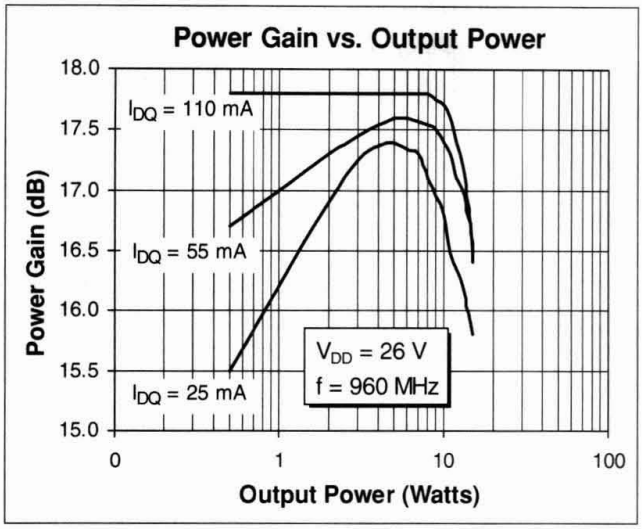
Maximum Ratings

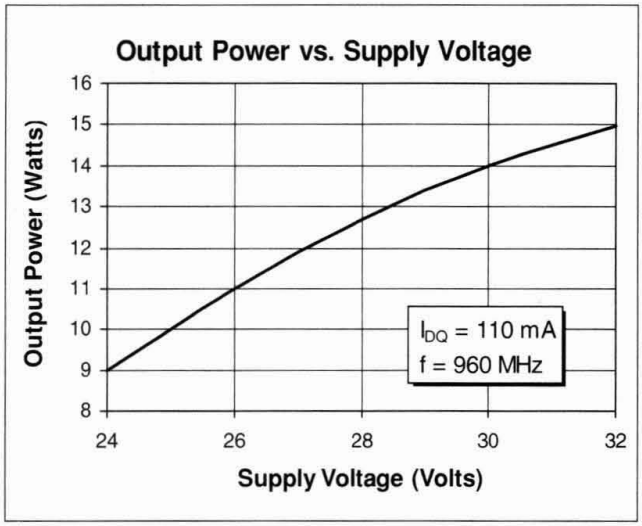
Parameter	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	65	Vdc
Gate-Source Voltage	V_{GS}	±20	Vdc
Operating Junction Temperature	T_J	200	°C
Total Device Dissipation at Above 25°C derate by	P_D	46 0.26	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{CASE} = 70°C)	$R_{\theta JC}$	3.8	°C/W

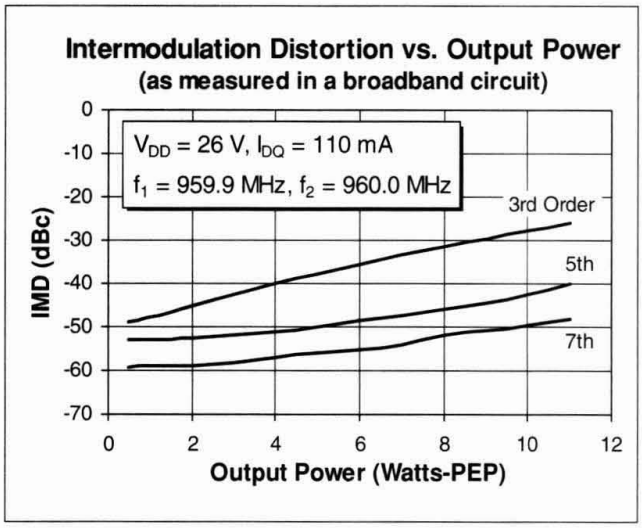
Typical Performance

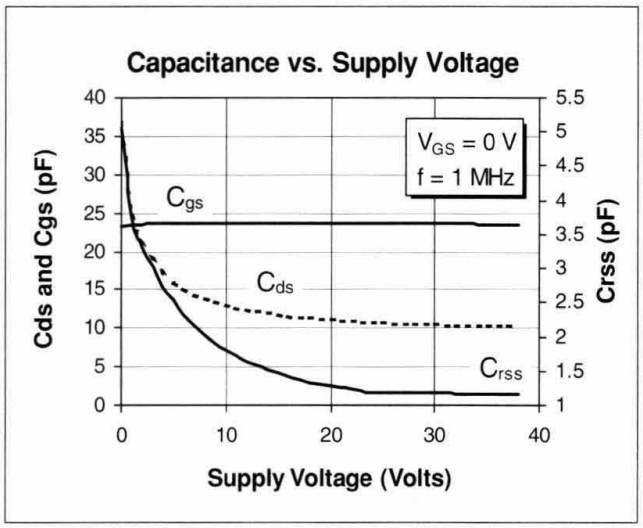


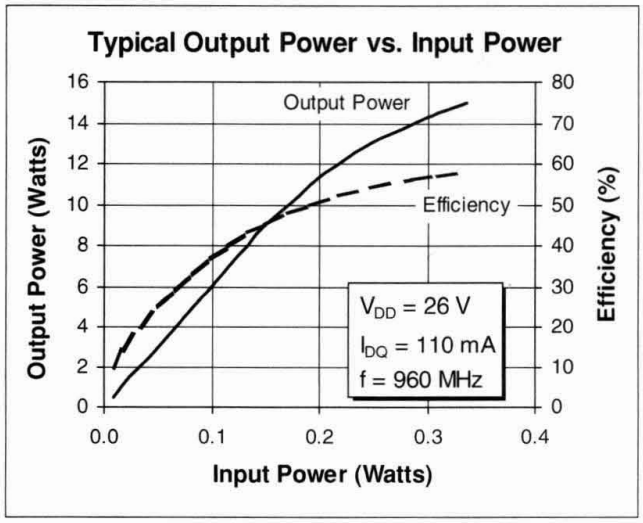



Power Gain vs. Output Power
Power Gain (dB)
Output Power (Watts)
I_{DQ} = 110 mA
I_{DQ} = 55 mA
I_{DQ} = 25 mA
V_{DD} = 26 V
f = 960 MHz
18.0
17.5
17.0
16.5
16.0
15.5
15.0
0
1
10
100


Output Power vs. Supply Voltage
Output Power (Watts)
Supply Voltage (Volts)
I_{DQ} = 110 mA
f = 960 MHz
16
15
14
13
12
11
10
9
8
24
26
28
30
32


Intermodulation Distortion vs. Output Power
(as measured in a broadband circuit)
IMD (dBc)
Output Power (Watts-PEP)
V_{DD} = 26 V, I_{DQ} = 110 mA
f_1 = 959.9 MHz, f_2 = 960.0 MHz
3rd Order
5th
7th
0
-10
-20
-30
-40
-50
-60
-70
0
2
4
6
8
10
12


Capacitance vs. Supply Voltage
Cds and Cgs (pF)
Crss (pF)
Supply Voltage (Volts)
V_{GS} = 0 V
f = 1 MHz
C_{gs}
C_{ds}
C_{rss}
40
35
30
25
20
15
10
5
0
5.5
5
4.5
4
3.5
3
2.5
2
1.5
1
0
10
20
30
40


Typical Output Power vs. Input Power
Output Power (Watts)
Efficiency (%)
Input Power (Watts)
Output Power
Efficiency
V_{DD} = 26 V
I_{DQ} = 110 mA
f = 960 MHz
16
14
12
10
8
6
4
2
0
80
70
60
50
40
30
20
10
0
0.0
0.1
0.2
0.3
0.4

PTF 10147

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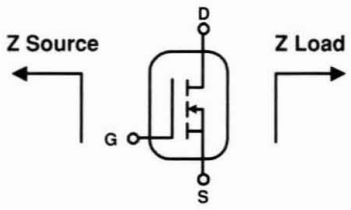
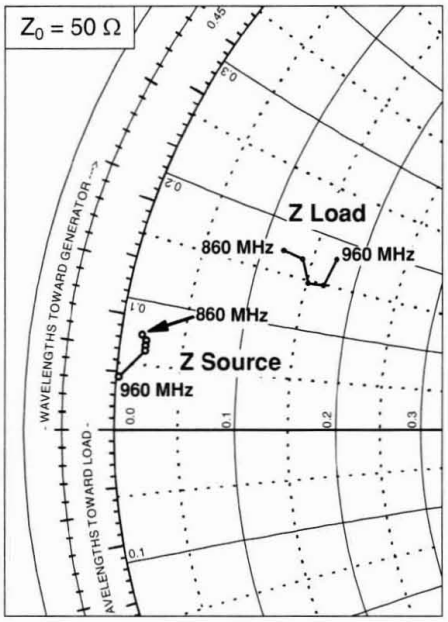
Impedance Data

V_{DD} = 26 V, I_{DQ} = 110 mA, P-1dB = 10 W



Frequency	Z Source Ω		Z Load Ω	
MHz	R	jX	R	jX
860	0.8	3.7	6.0	8.6
880	1.0	3.5	7.0	8.5
900	1.0	3.3	7.6	7.4
920	1.0	3.1	8.4	7.5
960	0.1	2.0	8.7	9.0

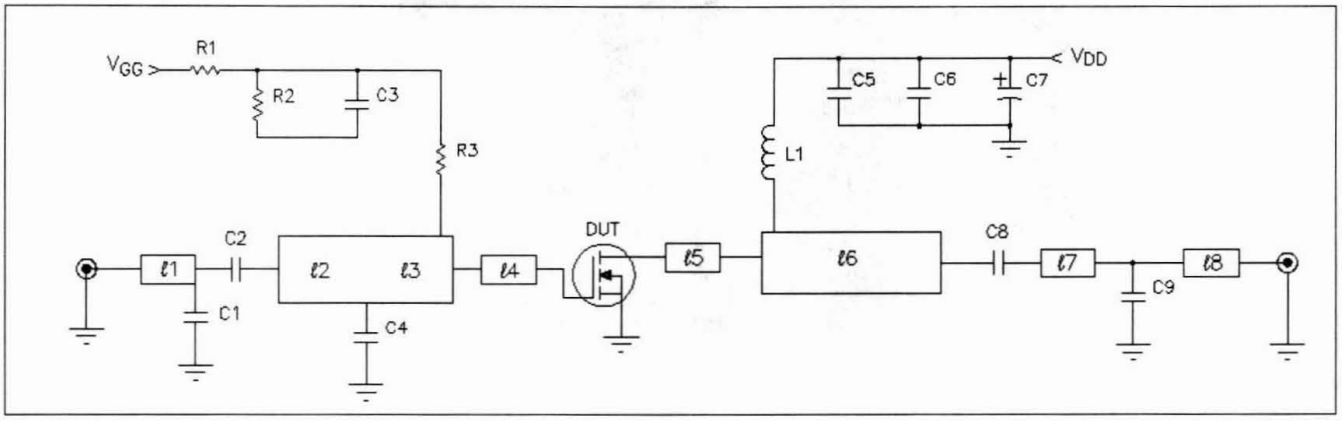


Typical Scattering Parameters

(V_{DS} = 26 V, I_D = 200 mA)

f	S11		S21		S12		S22	
(MHz)	Mag	Ang	Mag	Ang	Mag	Ang	Mag	Ang
100	0.939	-94.3	22.5	117	0.021	30.6	0.782	-51.1
150	0.917	-117	17.3	101	0.023	14.8	0.714	-65.5
200	0.903	-130	13.5	88.6	0.023	3.14	0.689	-76.1
250	0.898	-139	10.9	79.3	0.023	-5.63	0.691	-85.3
300	0.897	-145	8.90	71.5	0.022	-12.3	0.702	-92.8
350	0.904	-150	7.43	64.9	0.021	-17.9	0.722	-99.7
400	0.908	-154	6.29	58.7	0.020	-23.3	0.741	-106
450	0.910	-156	5.41	53.3	0.018	-27.1	0.763	-111
500	0.916	-159	4.68	48.4	0.017	-30.7	0.784	-116
550	0.919	-161	4.08	44.0	0.016	-32.8	0.802	-120
600	0.924	-163	3.60	40.0	0.014	-35.8	0.814	-125
650	0.931	-165	3.20	36.3	0.013	-37.8	0.835	-128
700	0.934	-166	2.86	33.0	0.012	-40.8	0.846	-131
750	0.937	-168	2.57	29.9	0.011	-40.7	0.850	-135
800	0.936	-169	2.31	26.7	0.009	-41.2	0.866	-138
850	0.942	-171	2.09	24.1	0.008	-40.0	0.875	-140
900	0.948	-172	1.91	21.5	0.007	-37.0	0.884	-142
950	0.947	-173	1.72	19.6	0.006	-38.5	0.879	-145
1000	0.950	-175	1.57	17.3	0.006	-37.7	0.884	-148
1050	0.953	-176	1.45	14.6	0.004	-25.4	0.897	-149
1100	0.956	-177	1.34	12.8	0.004	-17.8	0.896	-151
1150	0.956	-178	1.24	11.5	0.003	-9.27	0.895	-153
1200	0.959	-179	1.13	9.6	0.003	4.67	0.908	-155
1250	0.960	180	1.05	7.6	0.003	18.0	0.909	-156
1300	0.962	179	0.978	5.3	0.003	40.5	0.910	-158
1350	0.966	178	0.912	4.3	0.004	48.5	0.920	-160
1400	0.967	177	0.851	3.2	0.004	61.5	0.922	-161
1450	0.969	176	0.791	0.9	0.004	61.7	0.917	-163
1500	0.972	175	0.747	-0.3	0.005	66.6	0.928	-164

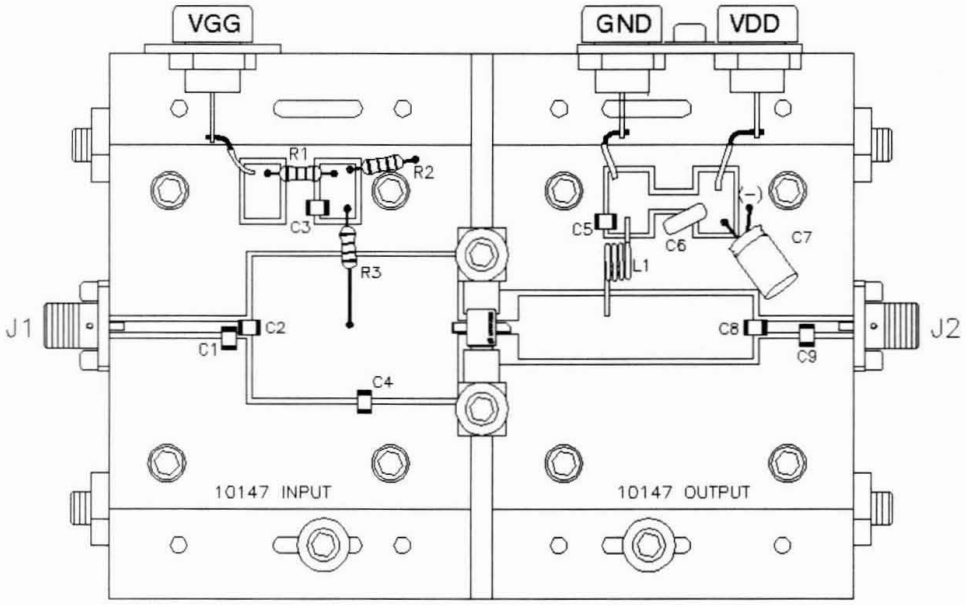
Test Circuit



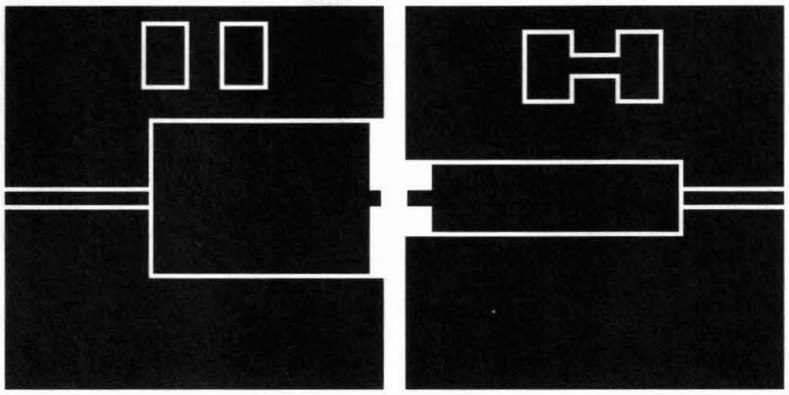
Test Circuit Schematic for f = 960 MHz

DUT	PTF 10147	LDMOS Field Effect Transistor
ℓ1	0.590 λ 960 GHz	Microstrip 50 Ω
ℓ2	0.094 λ 960 GHz	Microstrip 6.6 Ω
ℓ3	0.085 λ 960 GHz	Microstrip 6.6 Ω
ℓ4	0.006 λ 960 GHz	Microstrip 43 Ω
ℓ5	0.015 λ 960 GHz	Microstrip 43 Ω
ℓ6	0.200 λ 960 GHz	Microstrip 13.7 Ω
ℓ7	0.033 λ 960 GHz	Microstrip 50 Ω
ℓ8	0.043 λ 960 GHz	Microstrip 50 Ω

C1	3.0 pF	Capacitor ATC 100 B
C2,C3,C5,C8	36 pF, 50 V	Capacitor, ATC 100 B
C4	0.7 pF	Capacitor, ATC 100 B
C6	0.1 υF, 50 V	Capacitor, Digi-Key P4525-ND
C7	100 µF, 50 V	Capacitor, Digi-Key P5182-ND
C9	2.4 pF	Capacitor ATC 100 B
R1, R2, R3	220 Ω 1/4 W	Resistor, Digi-Key 2.2QBK
L1	4 Turn, 20 AWG, .120" I.D.	
Circuit Board	.028" Dielectric Thickness, ε_r = 4.0, AlliedSignal, G200, 2 oz. copper	



Assembly Diagram (not to scale)



Artwork (1 inch ———)

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www.ericsson.com/rfpower

Specifications subject to change without notice.
L3
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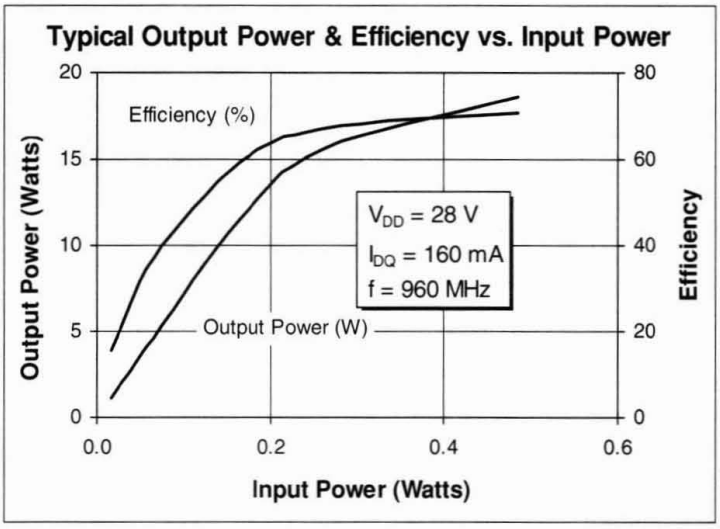
EUS/KR 1301-PTF 10147 Uen Rev. A 10-28-99

PTF 10137
12 Watts, 1.0 GHz
GOLDMOS™ Field Effect Transistor

Description

The PTF 10137 is a 12 Watt LDMOS FET intended for large signal amplifier applications to 1.0 GHz. It operates at 60% efficiency with 18 dB of gain. Nitride surface passivation and full gold metallization ensure excellent device lifetime and reliability.

- **Performance at 960 MHz, 28 Volts**
  - **Output Power = 12 Watts**
  - **Efficiency = 60% Typ**
  - **Power Gain = 18 dB Typ**
- **Full Gold Metallization**
- **Silicon Nitride Passivated**
- **Surface Mountable**
- **Available in Tape and Reel**
- **100% Lot Traceability**



Package 20244

RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Common Source Power Gain (V_{DD} = 28 V, P_{OUT} = 12 W, I_{DQ} = 160 mA, f = 960 MHz)	G_{ps}	16.5	18	—	dB
Power Output at 1 dB Compressed (V_{DD} = 28 V, I_{DQ} = 160 mA, f = 960 MHz)	P-1dB	12	15	—	Watts
Drain Efficiency (V_{DD} = 28 V, P_{OUT} = 12 W, I_{DQ} = 160 mA, f = 960 MHz)	η	55	60	—	%
Load Mismatch Tolerance (V_{DD} = 28 V, P_{OUT} = 12 W, I_{DQ} = 160 mA, f = 960 MHz —all phase angles at frequency of test)	Ψ	—	—	10:1	—

All published data at T_{CASE} = 25°C unless otherwise indicated.

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Electrical Characteristics (100% Tested)

Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 25 mA	$V_{(BR)DSS}$	65	—	—	Volts
Drain-Source Leakage Current	V_{DS} = 28 V, V_{GS} = 0 V	I_{DSS}	—	—	1	mA
Gate Threshold Voltage	V_{DS} = 10 V, I_D = 75 mA	$V_{GS(th)}$	3.0	—	5.0	Volts
Forward Transconductance	V_{DS} = 10 V, I_D = 0.5 A	g_{fs}	—	0.9	—	Siemens

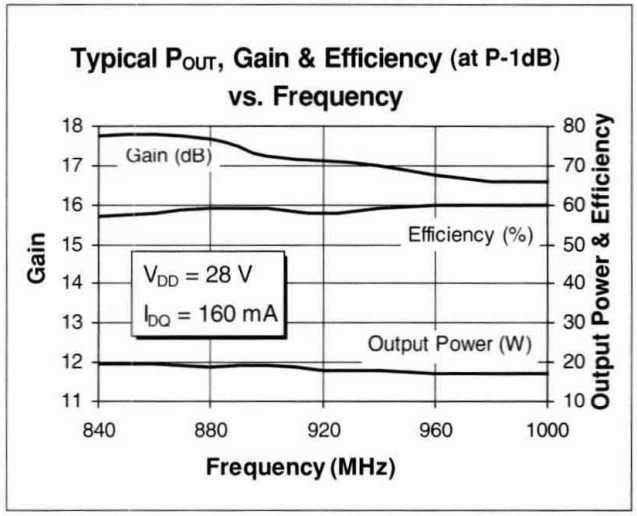
Maximum Ratings

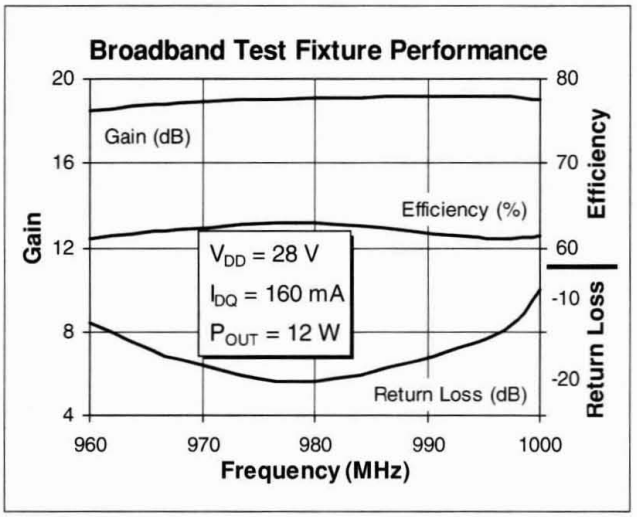
Parameter	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	65	Vdc
Gate-Source Voltage	V_{GS}	±20	Vdc
Operating Junction Temperature	T_J	200	°C
Total Device Dissipation Above 25°C derate by	P_D	58 0.33	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to 150	°C
Thermal Resistance (T_{CASE} = 70°C)	$R_{\theta JC}$	3.0	°C/W

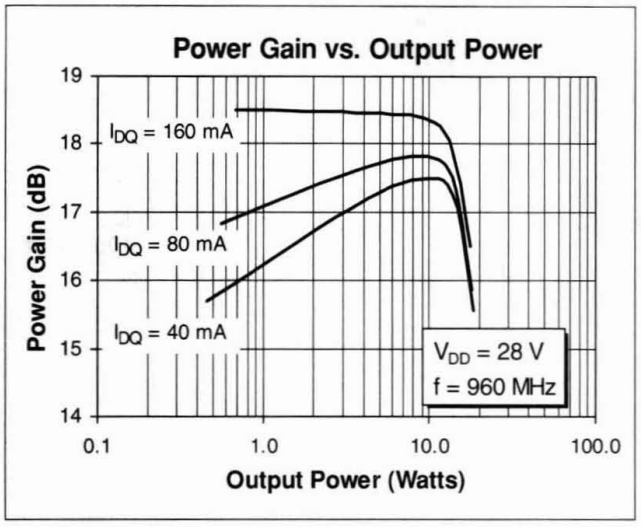
GOLDMOS™

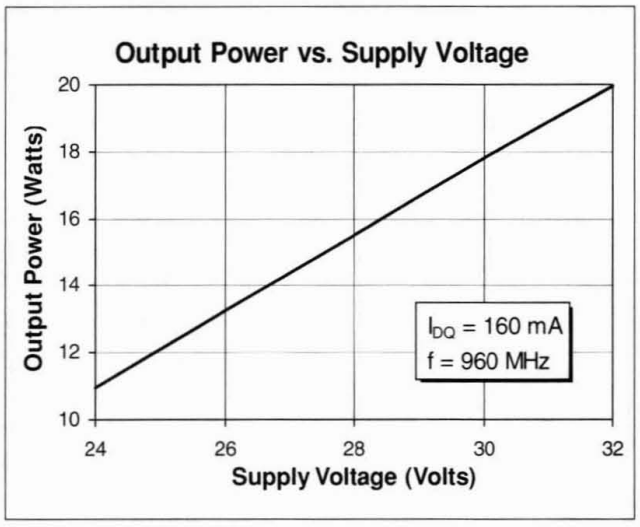
3

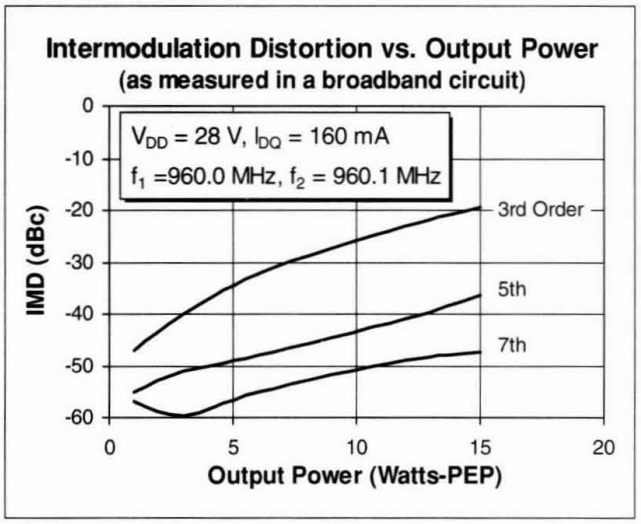
Typical Performance

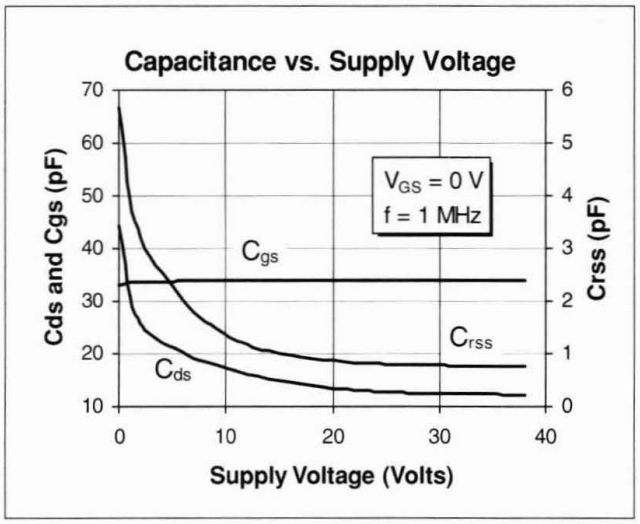


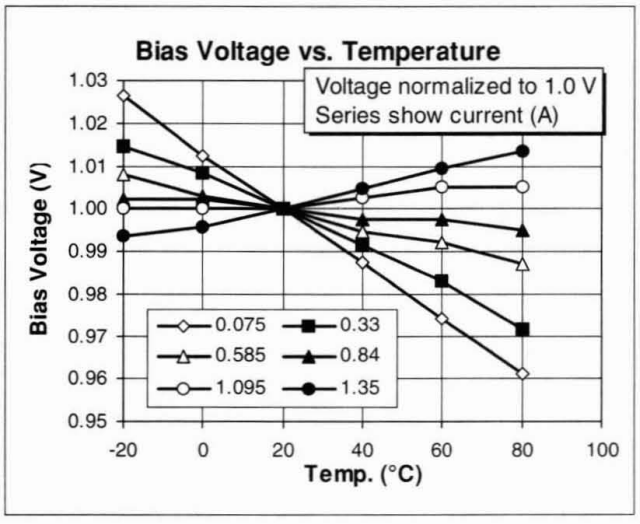



Power Gain vs. Output Power
Power Gain (dB)
Output Power (Watts)
I_{DQ} = 160 mA
I_{DQ} = 80 mA
I_{DQ} = 40 mA
V_{DD} = 28 V
f = 960 MHz
19
18
17
16
15
14
0.1
1.0
10.0
100.0


Output Power vs. Supply Voltage
Output Power (Watts)
Supply Voltage (Volts)
I_{DQ} = 160 mA
f = 960 MHz
20
18
16
14
12
10
24
26
28
30
32

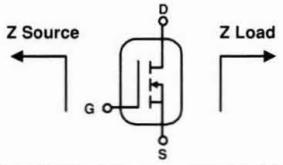

Intermodulation Distortion vs. Output Power
(as measured in a broadband circuit)
IMD (dBc)
Output Power (Watts-PEP)
V_{DD} = 28 V, I_{DQ} = 160 mA
f_1 =960.0 MHz, f_2 = 960.1 MHz
3rd Order
5th
7th
0
-10
-20
-30
-40
-50
-60
0
5
10
15
20

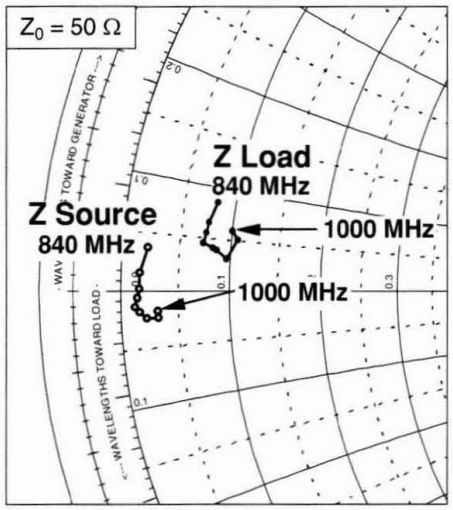

Capacitance vs. Supply Voltage
Cds and Cgs (pF)
Crss (pF)
Supply Voltage (Volts)
V_{GS} = 0 V
f = 1 MHz
C_{gs}
C_{rss}
C_{ds}
70
60
50
40
30
20
10
6
5
4
3
2
1
0
0
10
20
30
40


Bias Voltage vs. Temperature
Voltage normalized to 1.0 V
Series show current (A)
Bias Voltage (V)
Temp. (°C)
0.075
0.33
0.585
0.84
1.095
1.35
1.03
1.02
1.01
1.00
0.99
0.98
0.97
0.96
0.95
-20
0
20
40
60
80
100

Impedance Data

V_{DD} = 28 V, I_{DQ} = 160 mA, P-1dB = 18 W





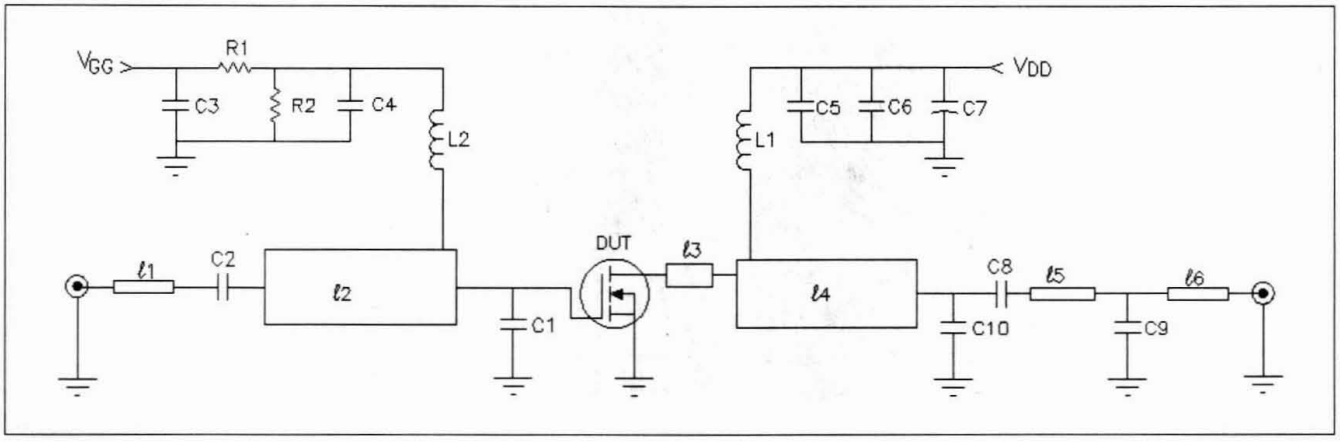
Frequency	Z Source Ω		Z Load Ω	
MHz	R	jX	R	jX
840	1.1	1.9	4.1	4.3
860	0.8	0.8	3.8	3.3
880	0.8	0.1	3.7	2.8
900	0.7	-0.3	3.6	2.3
920	0.6	-0.7	4.1	2.1
940	0.8	-0.9	4.3	2.0
960	1.1	-1.2	4.8	1.6
980	1.6	-1.2	5.3	2.6
1000	1.6	-0.9	5.0	3.7

Typical Scattering Parameters

(V_{DS} = 28 V, I_D = 450 mA)

f	S11		S21		S12		S22	
(MHz)	Mag	Ang	Mag	Ang	Mag	Ang	Mag	Ang
100	0.862	-126	25.8	101	0.018	11.5	0.575	-78.7
150	0.866	-135	21.1	93.6	0.018	3.96	0.583	-86.4
200	0.872	-146	15.5	80.9	0.018	-5.92	0.587	-97.4
250	0.881	-153	12.0	71.6	0.017	-13.4	0.613	-106
300	0.888	-157	9.57	63.7	0.016	-19.1	0.646	-113
350	0.896	-161	7.86	57.0	0.015	-24.0	0.679	-119
400	0.905	-164	6.55	51.0	0.013	-27.9	0.713	-124
450	0.910	-166	5.53	45.7	0.012	-31.0	0.742	-129
500	0.920	-168	4.74	40.8	0.011	-32.8	0.770	-133
550	0.927	-169	4.09	36.6	0.009	-34.0	0.792	-137
600	0.932	-171	3.57	32.4	0.008	-35.0	0.813	-141
650	0.940	-173	3.15	28.9	0.007	-34.2	0.834	-144
700	0.942	-174	2.79	25.5	0.006	-32.7	0.849	-147
750	0.948	-175	2.49	22.1	0.005	-27.9	0.865	-150
800	0.953	-177	2.23	19.3	0.004	-20.5	0.874	-152
850	0.955	-178	2.01	16.2	0.003	-8.60	0.884	-155
900	0.958	-179	1.83	13.6	0.003	10.9	0.896	-157
950	0.961	-180	1.66	11.1	0.003	32.3	0.902	-159
1000	0.963	179	1.52	8.52	0.003	47.7	0.912	-161
1050	0.967	178	1.39	6.44	0.004	57.8	0.917	-162
1100	0.967	177	1.27	4.07	0.004	63.1	0.921	-164
1150	0.967	176	1.18	1.96	0.005	68.8	0.929	-166
1200	0.970	175	1.09	0.12	0.006	70.7	0.932	-167
1250	0.970	174	1.01	-2.03	0.006	73.2	0.937	-169
1300	0.972	173	0.943	-3.66	0.007	74.5	0.943	-170
1350	0.973	172	0.874	-5.57	0.008	75.7	0.943	-172
1400	0.978	172	0.825	-7.37	0.009	75.8	0.950	-173
1450	0.978	171	0.772	-8.77	0.009	76.4	0.948	-174
1500	0.981	170	0.729	-10.7	0.010	76.6	0.952	-176
1550	0.981	169	0.689	-12.1	0.011	77.2	0.958	-177
1600	0.982	168	0.647	-13.9	0.012	76.3	0.958	-178
1650	0.983	167	0.615	-15.7	0.013	75.0	0.966	-179
1700	0.983	167	0.580	-16.9	0.013	74.7	0.964	-180
1750	0.983	166	0.549	-18.7	0.014	74.4	0.961	179
1800	0.983	165	0.525	-20.3	0.015	74.7	0.962	178
1850	0.981	164	0.499	-21.8	0.015	74.0	0.958	176
1900	0.981	163	0.478	-23.4	0.016	72.9	0.967	175
1950	0.981	162	0.454	-24.3	0.017	72.1	0.967	175
2000	0.981	161	0.431	-26.0	0.018	71.3	0.967	173
2050	0.981	161	0.414	-27.3	0.018	71.3	0.969	173
2100	0.979	160	0.395	-28.6	0.019	70.8	0.963	172
2150	0.979	159	0.382	-30.0	0.019	69.8	0.969	170
2200	0.975	158	0.371	-30.7	0.020	69.1	0.969	169

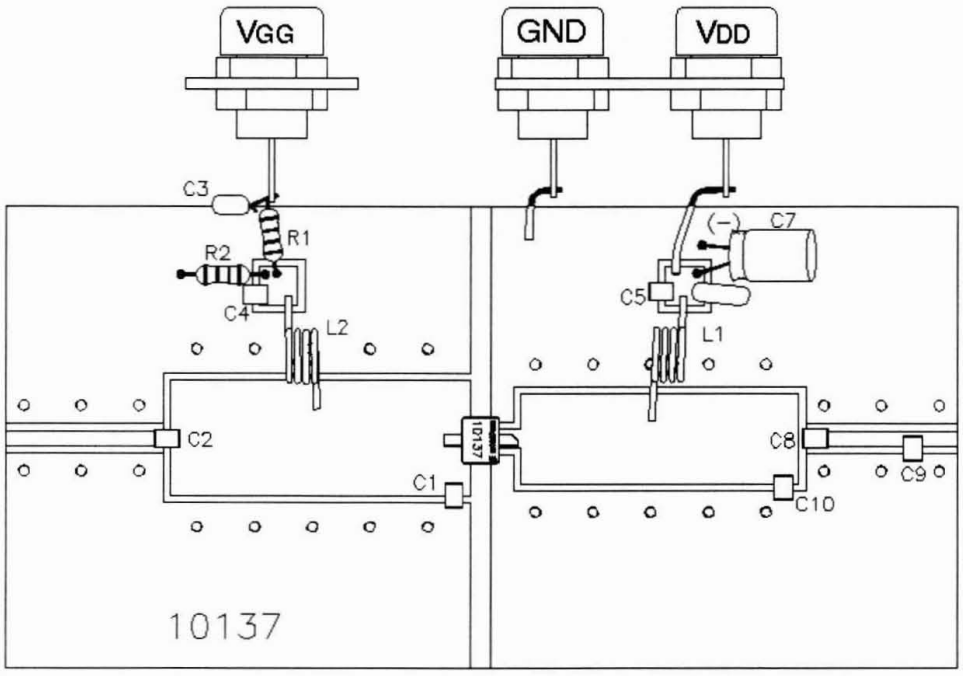
Test Circuit



Test Circuit Schematic for f = 960 MHz

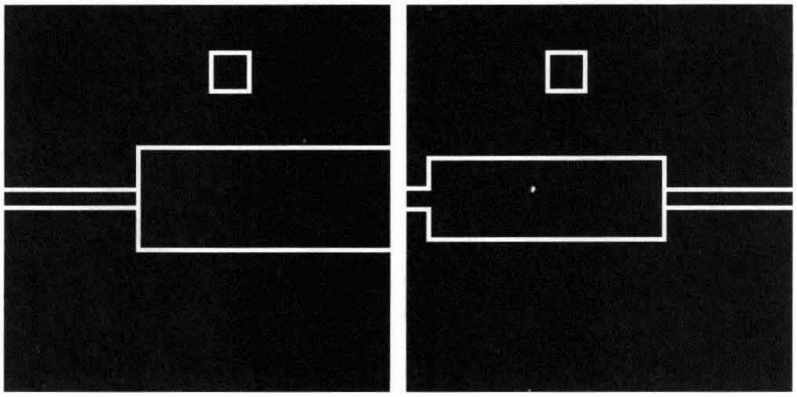
DUT	PTF 10137	
ℓ1, ℓ6		Microstrip 50 Ω
ℓ2	0.197 λ 960 MHz	Microstrip 10 Ω
ℓ3	0.018 λ 960 MHz	Microstrip 44 Ω
ℓ4	0.184 λ 960 MHz	Microstrip 12.7 Ω
ℓ5	0.047 λ 960 MHz	Microstrip 50 Ω

C1	ATC 100 B	Capacitor, 8.2 pF, ATC 100 B
C2,C4,C5,C8	ATC 100 B	Capacitor, 36 pF, ATC 100 B
C3,C6	Digi-Key P4525-ND	Capacitor, 0.1 µF, 50V
C7	Digi-Key P5182-ND	Capacitor, 100 µF, 50V
C9, C10	ATC 100 B	2.0 pF Capacitor, ATC 100 B
R1, R2	Digi-Key 2.2 QBK	Resistor, 220 Ω, 1/4W
L1,L2	N/A	4 Turn, 20 AWG, .120 I.D.
Circuit Board	.028" Dielectric Thickness, ε_r = 4.0, AlliedSignal, G200, 2 oz. copper	



Assembly Diagram (not to scale)

Test Circuit



Artwork (1 inch *)*

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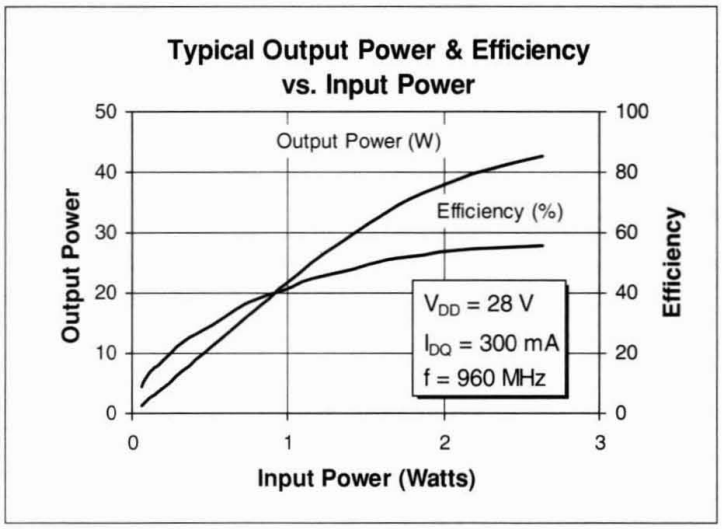
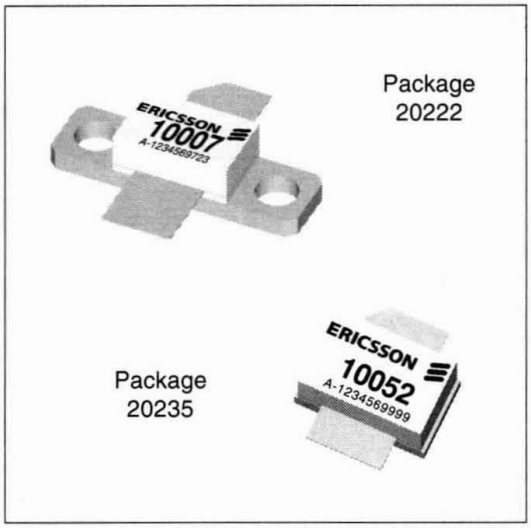
PTF 10007
35 Watts, 1.0 GHz
GOLDMOS™ Field Effect Transistor

Description

The PTF 10007 is a 35 Watt LDMOS FET intended for large signal amplifier applications to 1.0 GHz. It operates at 55% efficiency and 13.5 dB of gain. Nitride surface passivation and gold metallization ensure excellent device lifetime and reliability.

- **Performance at 960 MHz, 28 Volts**
  - **Output Power = 35 Watts**
  - **Power Gain = 13.5 dB Typ**
  - **Efficiency = 55% Typ**
- **Full Gold Metallization**
- **Silicon Nitride Passivated**
- **Back Side Common Source**
- **100% lot traceability**
- **Available in Package 20235 as PTE 10052**





Maximum Ratings

Parameter	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	60	Vdc
Gate-Source Voltage	V_{GS}	±20	Vdc
Operating Junction Temperature	T_J	200	°C
Total Device Dissipation at T_{flange} = 25°C Above 25°C derate by	P_D	120 0.7	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{flange} = 70°C)	$R_{\theta JC}$	1.4	°C/W

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Electrical Characteristics (100% Tested)

Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 5 mA	$V_{(BR)DSS}$	65	70	—	Volts
Drain-Source Leakage Current	V_{DS} = 28 V, V_{GS} = 0 V	I_{DSS}	—	—	1.0	mA
Gate Threshold Voltage	V_{DS} = 10 V, I_D = 75 mA	$V_{GS(th)}$	3.0	—	5.0	Volts
Forward Transconductance	V_{DS} = 10 V, I_D = 3 A	g_{fs}	—	2.8	—	Siemens

RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{DD} = 28 V, P_{OUT} = 35 W, I_{DQ} = 300 mA, f = 960 MHz)	G_{ps}	12.0	13.5	—	dB
Power Output at 1 dB Compression (V_{DD} = 28 V, I_{DQ} = 300 mA, f = 960 MHz)	P-1dB	35	—	—	Watts
Drain Efficiency (V_{DD} = 28 V, P_{OUT} = 35 W, I_{DQ} = 300 mA, f = 960 MHz)	η	50	55	—	%
Load Mismatch Tolerance (V_{DD} = 28 V, P_{OUT} = 35 W, I_{DQ} = 300 mA, f = 960 MHz— all phase angles at frequency of test)	Ψ	—	—	10:1	—

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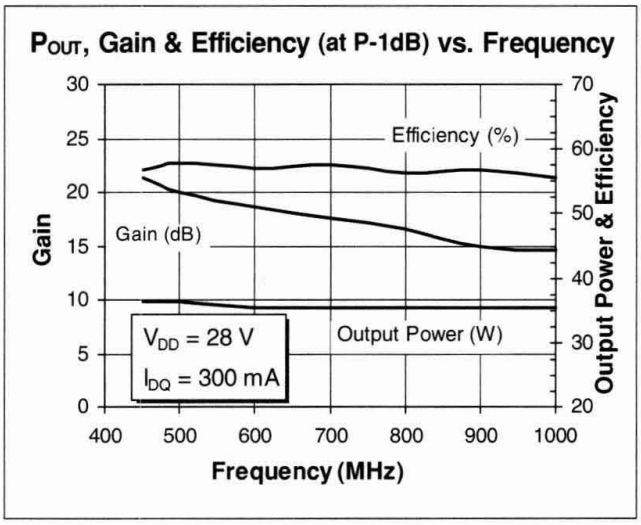
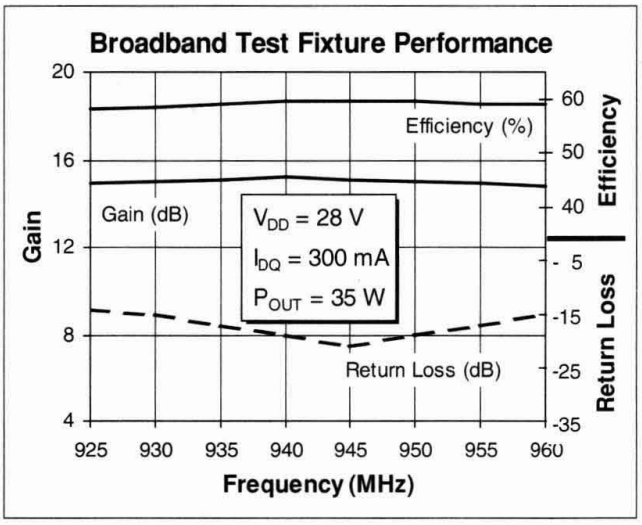
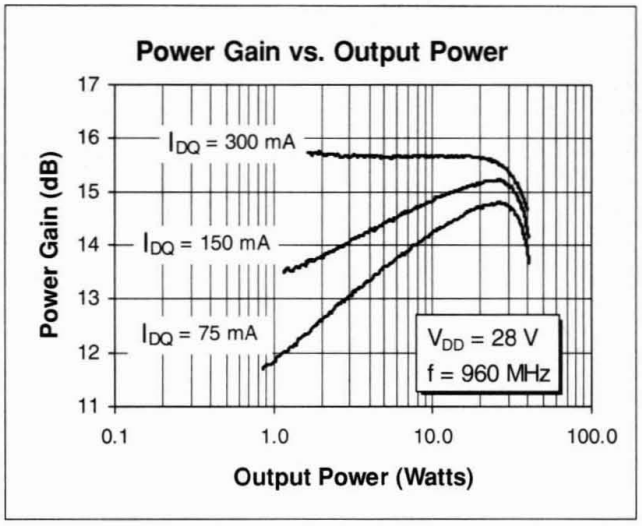
3

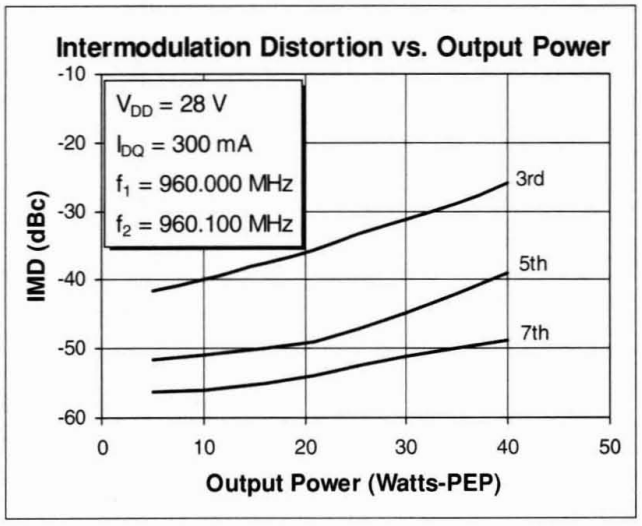
Typical Performance

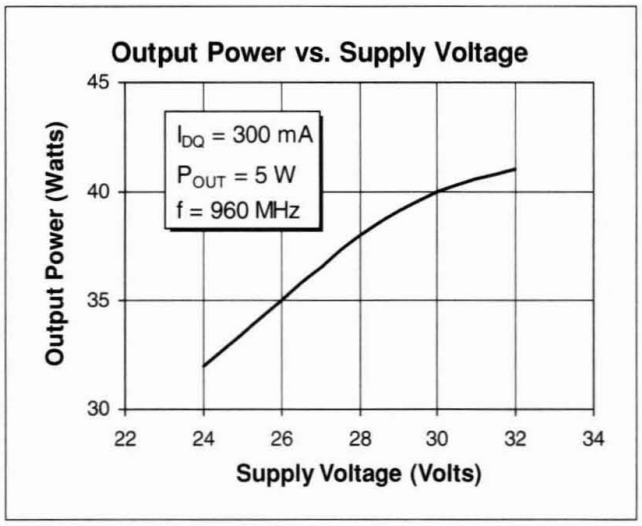


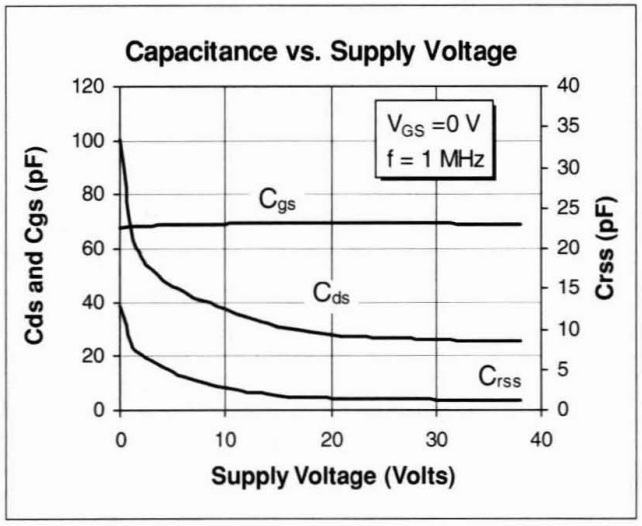


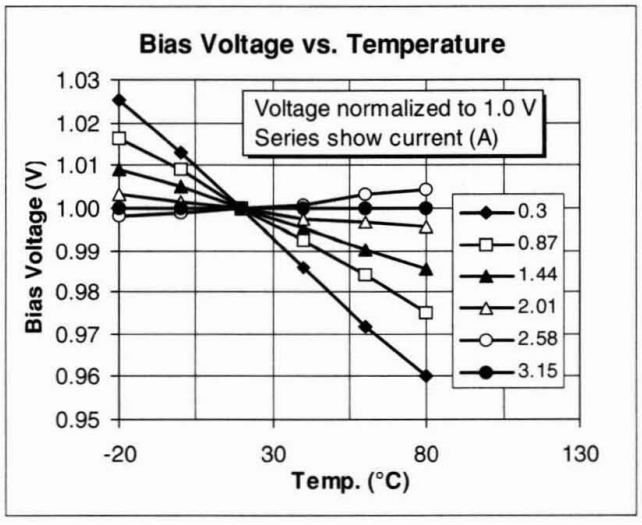
Typical Performance





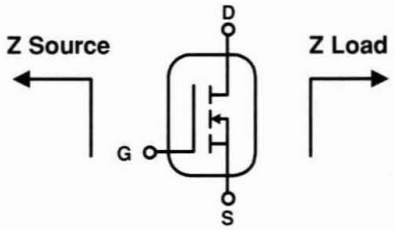


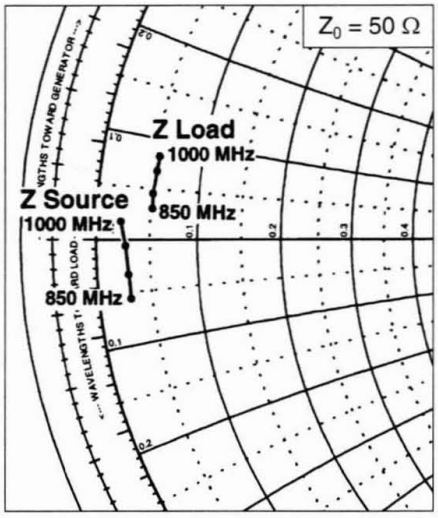




Impedance Data (shown for fixed-tuned broadband circuit)

V_{DD} = 28 V, P_{OUT} = 35 W, I_{DQ} = 300 mA





Frequency	Z Source Ω		Z Load Ω	
MHz	R	jX	R	jX
850	1.48	-2.80	2.60	1.55
900	1.45	-1.65	2.60	2.30
950	1.35	-0.30	2.68	3.40
1000	1.10	0.88	2.70	4.15

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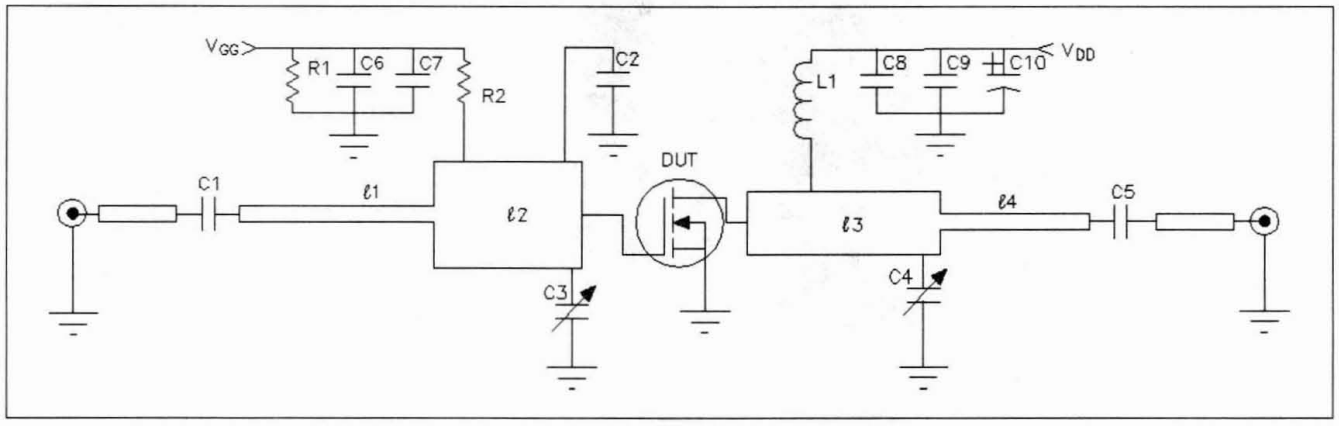
Typical Scattering Parameters

(V_{DS} = 28 V, I_D = 2.0 A)

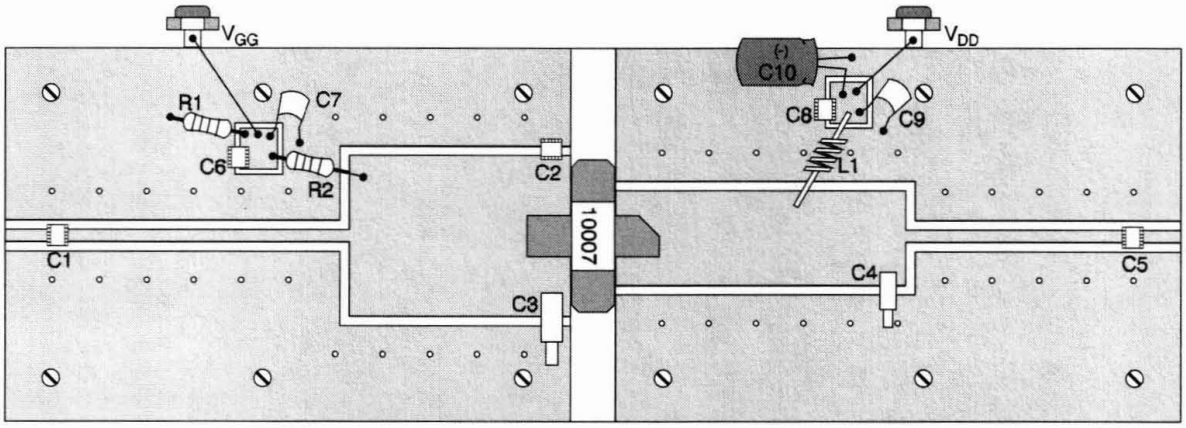
f	S11		S21		S12		S22	
(MHz)	Mag	Ang	Mag	Ang	Mag	Ang	Mag	Ang
400	0.948	-167	3.668	33	0.006	-37	0.858	-149
420	0.951	-168	3.403	32	0.005	-37	0.866	-150
440	0.955	-168	3.161	30	0.005	-37	0.877	-151
460	0.956	-168	2.943	29	0.005	-36	0.886	-152
480	0.957	-168	2.745	28	0.004	-38	0.892	-152
500	0.959	-168	2.575	27	0.004	-35	0.898	-153
520	0.960	-169	2.421	26	0.004	-34	0.903	-153
540	0.962	-169	2.282	25	0.004	-30	0.907	-154
560	0.963	-169	2.151	24	0.003	-29	0.911	-155
580	0.964	-169	2.024	22	0.003	-28	0.913	-155
600	0.964	-169	1.907	22	0.003	-23	0.919	-156
620	0.965	-169	1.806	21	0.002	-20	0.925	-156
640	0.967	-169	1.72	21	0.002	-13	0.929	-156
660	0.966	-170	1.636	20	0.002	-6	0.929	-157
680	0.967	-170	1.558	19	0.002	3	0.929	-157
700	0.967	-170	1.483	18	0.002	8	0.928	-157
720	0.968	-170	1.413	18	0.002	21	0.930	-158
740	0.968	-170	1.345	17	0.002	25	0.932	-158
760	0.967	-170	1.281	17	0.002	33	0.935	-159
780	0.966	-170	1.228	17	0.002	44	0.937	-159
800	0.967	-170	1.179	16	0.002	51	0.938	-159
820	0.968	-170	1.134	16	0.002	55	0.939	-159
840	0.967	-170	1.088	15	0.002	59	0.938	-160
860	0.967	-170	1.039	15	0.003	67	0.938	-160
880	0.967	-170	0.993	14	0.003	68	0.938	-160
900	0.966	-170	0.957	14	0.003	73	0.941	-161
920	0.966	-171	0.922	14	0.003	75	0.943	-161
940	0.966	-171	0.890	14	0.003	79	0.941	-161
960	0.966	-171	0.859	13	0.004	81	0.942	-161
980	0.966	-171	0.827	13	0.004	83	0.943	-161
1000	0.965	-171	0.794	12	0.004	86	0.942	-162

Test Circuit

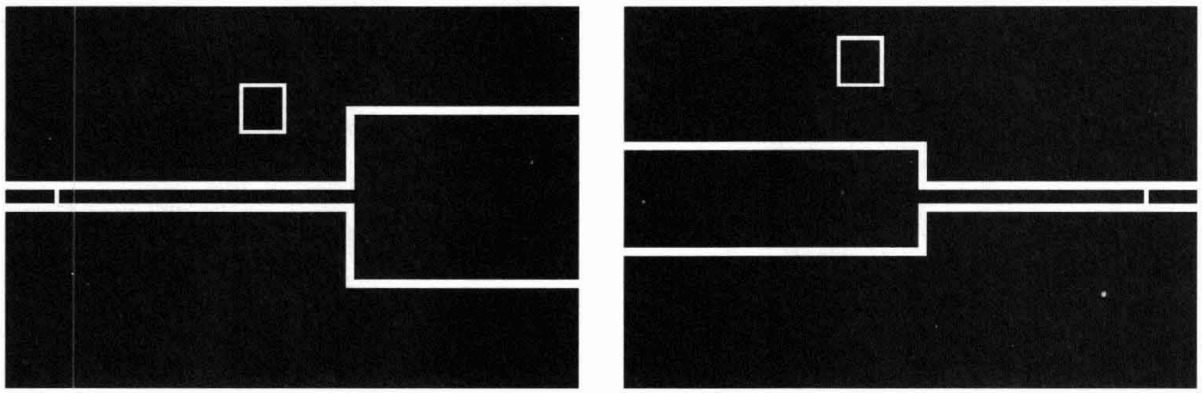


Test Circuit Schematic for f = 960 MHz

DUT	PTF 10007	
C1, C5	39 pF, Capacitor ATC 100 B	
C2	7.5 pF, Capacitor ATC 100 B	
C3	0.6–6.0 pF, Trimmer Capacitor, Johanson, 5701-PC	
C4	0.35–3.5 pF, Trimmer Capacitor, Johanson, 5801-PC	
C6, C8	51 pF, Capacitor ATC 100 B	
C7, C9	0.1 µF, 50 V, Capacitor, Digi-Key P4917-ND	
C10	100 µF, 50 V, Electrolytic Capacitor, Digi-Key P5276	
L1	4 Turn, #20 AWG, .120" I.D.	
R1	1 K, 1/4 W Resistor	
R2	10 K, 1/4 W Resistor	
ℓ1, ℓ4		Microstrip 50 Ω
ℓ2	0.185 λ 960 MHz	Microstrip 5.70 Ω
ℓ3	0.240 λ 960 MHz	Microstrip 9.30 Ω
Circuit Board	.028" Dielectric Thickness, ε_r = 4.0, AlliedSignal, G200, 2 oz. copper	



Parts Layout (not to scale)



Artwork (1 inch ———)

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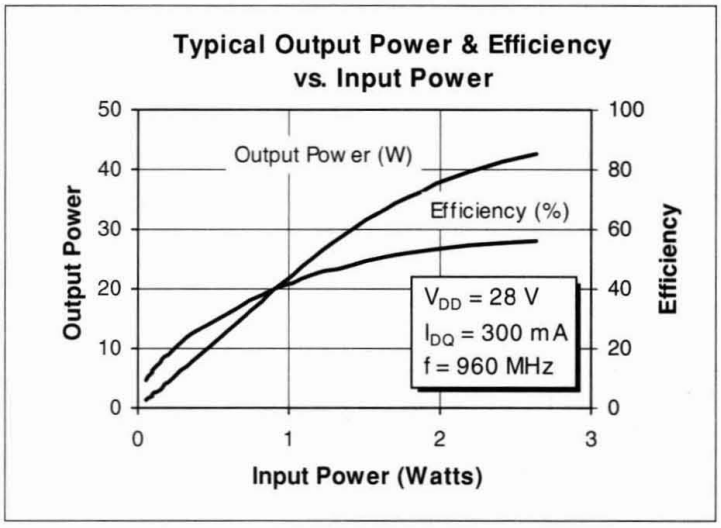
PTF 10052
35 Watts, 1.0 GHz
GOLDMOS™ Field Effect Transistor

Description

The PTF 10052 is a 35 Watt LDMOS FET intended for large signal amplifier applications to 1.0 GHz. It operates at 55% efficiency and 13.5 dB of gain. Nitride surface passivation and full gold metallization ensure excellent device lifetime and reliability.

- **Performance at 960 MHz, 28 Volts**
  - **Output Power = 35 Watts**
  - **Power Gain = 13.5 dB Typ**
  - **Efficiency = 55% Typ**
- **Full Gold Metallization**
- **Silicon Nitride Passivated**
- **Back Side Common Source**
- **100% Lot Traceability**
- **Available in Package 20222 as PTF 10007**



Package 20235

Package 20222

RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{DD} = 28 V, P_{OUT} = 35 W, I_{DQ} = 300 mA, f = 960 MHz)	G_{ps}	12.0	13.5	—	dB
Power Output at 1 dB Compression (V_{DD} = 28 V, I_{DQ} = 300 mA, f = 960 MHz)	P-1dB	35	—	—	Watts
Drain Efficiency (V_{DD} = 28 V, P_{OUT} = 35 W, I_{DQ} = 300 mA, f = 960 MHz)	η	50	55	—	%
Load Mismatch Tolerance (V_{DD} = 28 V, P_{OUT} = 35 W, I_{DQ} = 300 mA, f = 960 MHz— all phase angles at frequency of test)	Ψ	—	—	10:1	—

All published data at T_{CASE} = 25°C unless otherwise indicated.

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PTF 10052

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Electrical Characteristics (100% Tested)

Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 5 mA	$V_{(BR)DSS}$	65	70	—	Volts
Drain-Source Leakage Current	V_{DS} = 28 V, V_{GS} = 0 V	I_{DSS}	—	—	1.0	mA
Gate Threshold Voltage	V_{DS} = 10 V, I_D = 75 mA	$V_{GS(th)}$	3.0	—	5.0	Volts
Forward Transconductance	V_{DS} = 10 V, I_D = 3 A	g_{fs}	—	2.8	—	Siemens

Maximum Ratings

Parameter	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	60	Vdc
Gate-Source Voltage	V_{GS}	±20	Vdc
Operating Junction Temperature	T_J	200	°C
Total Device Dissipation Above 25°C derate by	P_D	120 0.7	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{CASE} = 70°C)	$R_{\theta JC}$	1.4	°C/W

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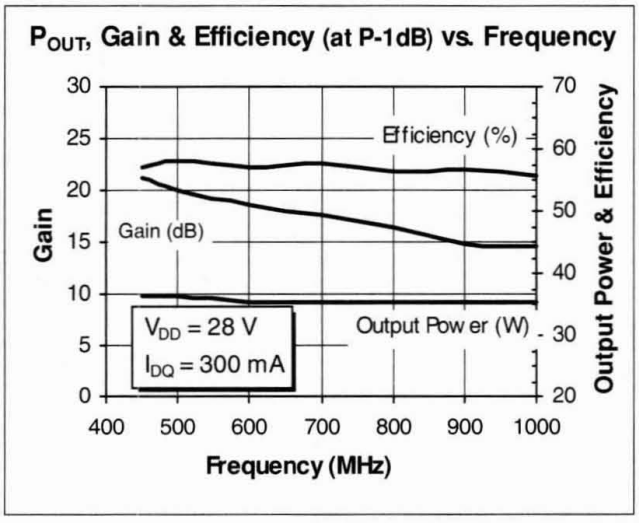
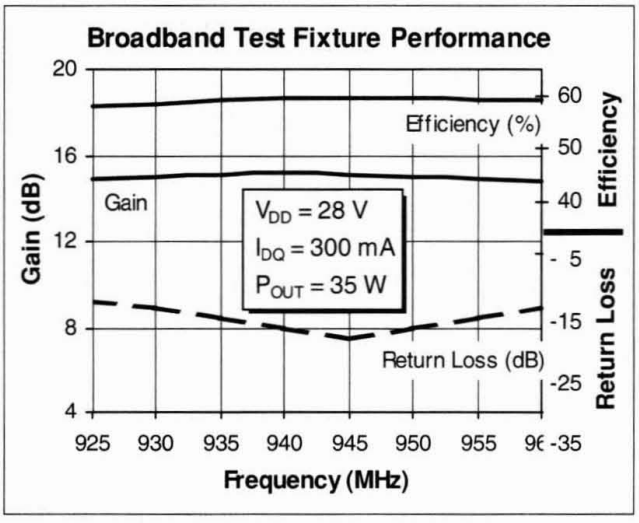
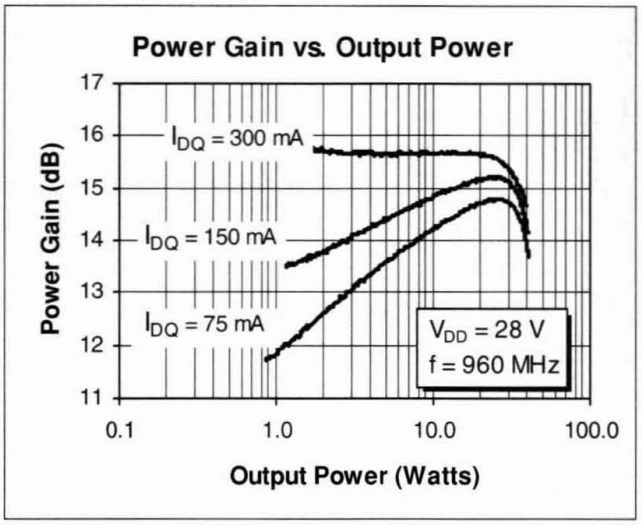
3

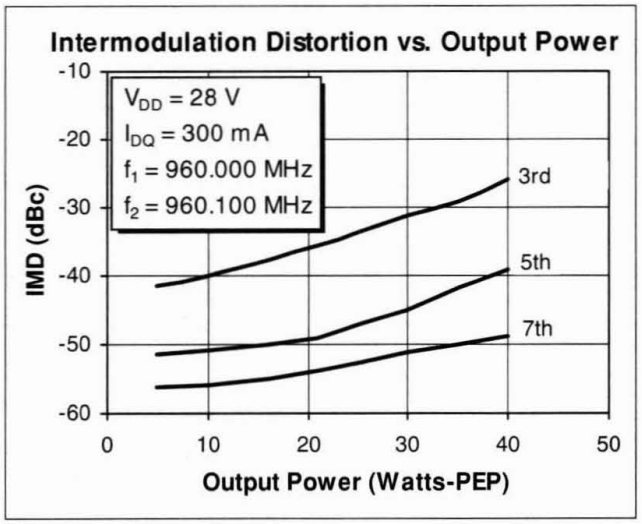
Typical Performance

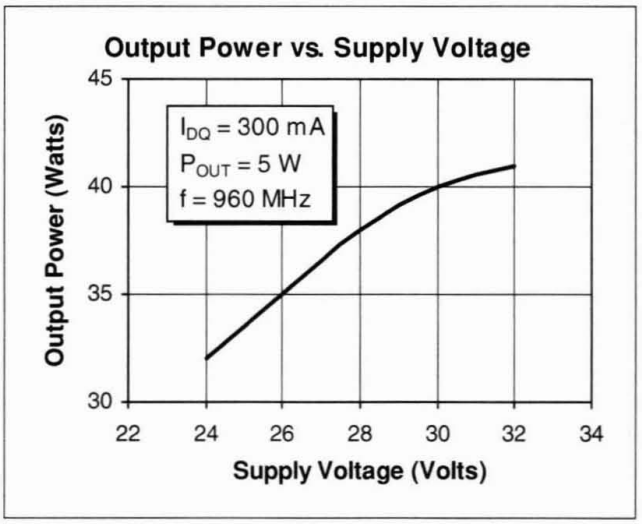


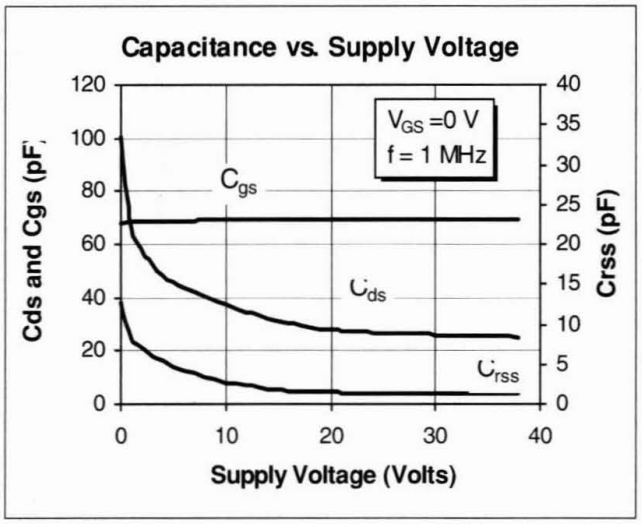


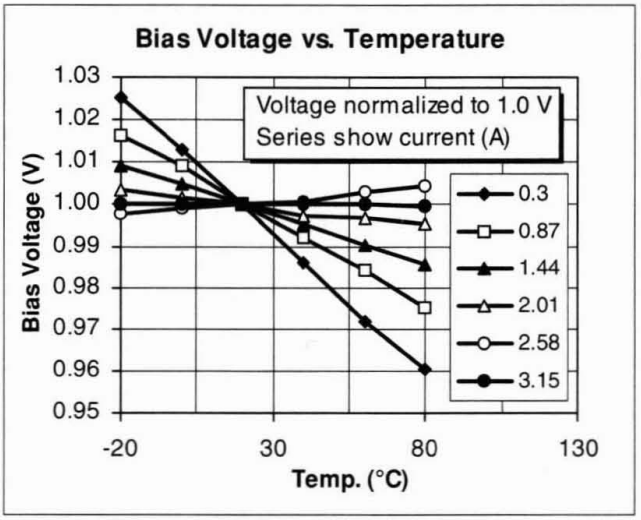
Typical Performance











PTF 10052

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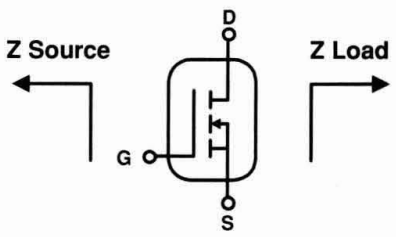
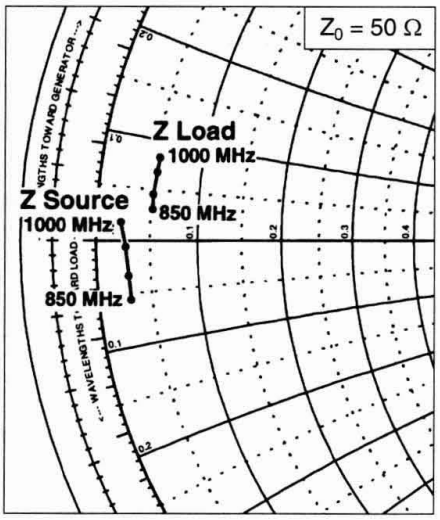
Impedance Data (shown for fixed-tuned broadband circuit)

V_{DD} = 28 V, P_{OUT} = 35 W, I_{DQ} = 300 mA





Frequency	Z Source Ω		Z Load Ω	
MHz	R	jX	R	jX
850	1.48	-2.80	2.60	1.55
900	1.45	-1.65	2.60	2.30
950	1.35	-0.30	2.68	3.40
1000	1.10	0.88	2.70	4.15

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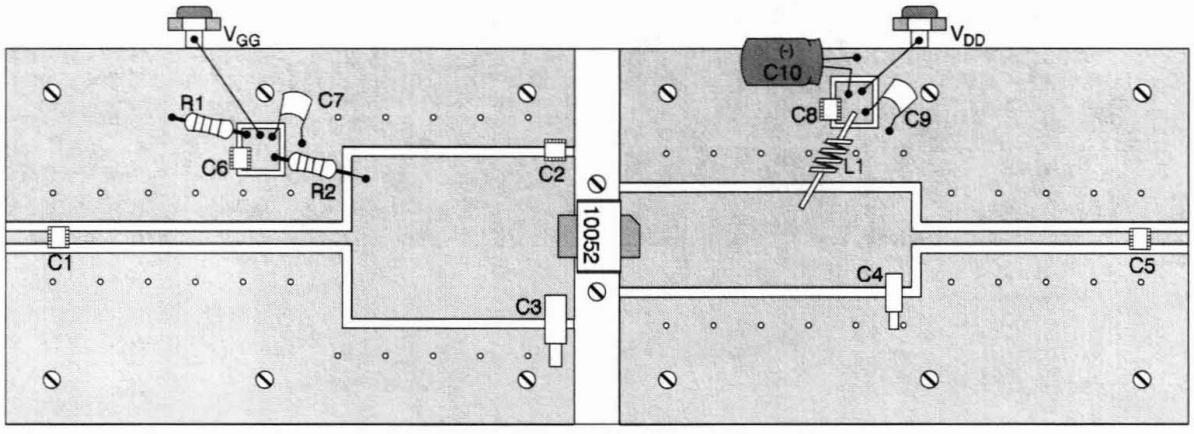
Typical Scattering Parameters

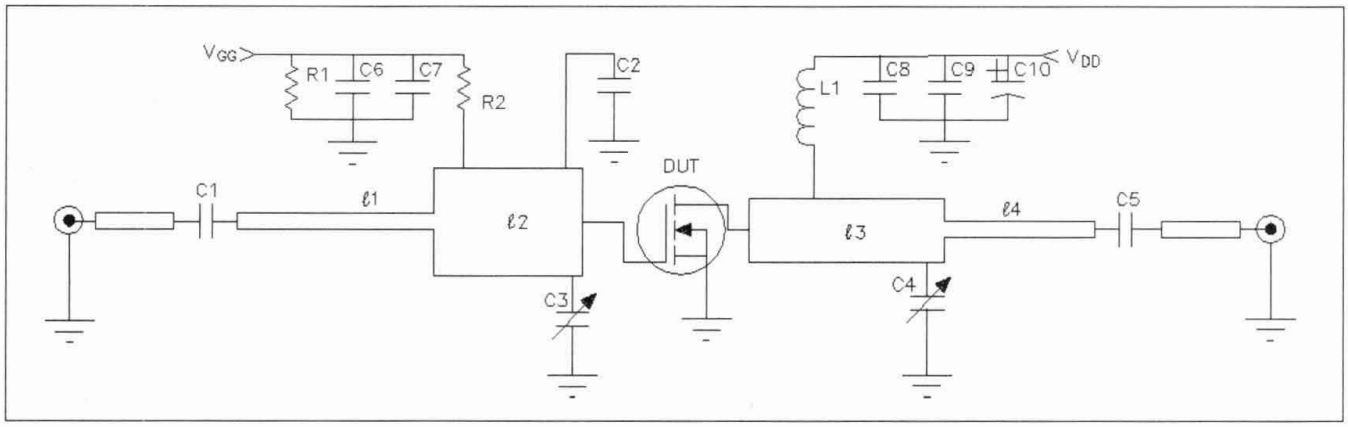
(V_{DS} = 28 V, I_D = 2.0 A)

f	S11		S21		S12		S22	
(MHz)	Mag	Ang	Mag	Ang	Mag	Ang	Mag	Ang
400	0.948	-167	3.668	33	0.006	-37	0.858	-149
420	0.951	-168	3.403	32	0.005	-37	0.866	-150
440	0.955	-168	3.161	30	0.005	-37	0.877	-151
460	0.956	-168	2.943	29	0.005	-36	0.886	-152
480	0.957	-168	2.745	28	0.004	-38	0.892	-152
500	0.959	-168	2.575	27	0.004	-35	0.898	-153
520	0.960	-169	2.421	26	0.004	-34	0.903	-153
540	0.962	-169	2.282	25	0.004	-30	0.907	-154
560	0.963	-169	2.151	24	0.003	-29	0.911	-155
580	0.964	-169	2.024	22	0.003	-28	0.913	-155
600	0.964	-169	1.907	22	0.003	-23	0.919	-156
620	0.965	-169	1.806	21	0.002	-20	0.925	-156
640	0.967	-169	1.72	21	0.002	-13	0.929	-156
660	0.966	-170	1.636	20	0.002	-6	0.929	-157
680	0.967	-170	1.558	19	0.002	3	0.929	-157
700	0.967	-170	1.483	18	0.002	8	0.928	-157
720	0.968	-170	1.413	18	0.002	21	0.930	-158
740	0.968	-170	1.345	17	0.002	25	0.932	-158
760	0.967	-170	1.281	17	0.002	33	0.935	-159
780	0.966	-170	1.228	17	0.002	44	0.937	-159
800	0.967	-170	1.179	16	0.002	51	0.938	-159
820	0.968	-170	1.134	16	0.002	55	0.939	-159
840	0.967	-170	1.088	15	0.002	59	0.938	-160
860	0.967	-170	1.039	15	0.003	67	0.938	-160
880	0.967	-170	0.993	14	0.003	68	0.938	-160
900	0.966	-170	0.957	14	0.003	73	0.941	-161
920	0.966	-171	0.922	14	0.003	75	0.943	-161
940	0.966	-171	0.890	14	0.003	79	0.941	-161
960	0.966	-171	0.859	13	0.004	81	0.942	-161
980	0.966	-171	0.827	13	0.004	83	0.943	-161
1000	0.965	-171	0.794	12	0.004	86	0.942	-162

Test Circuit

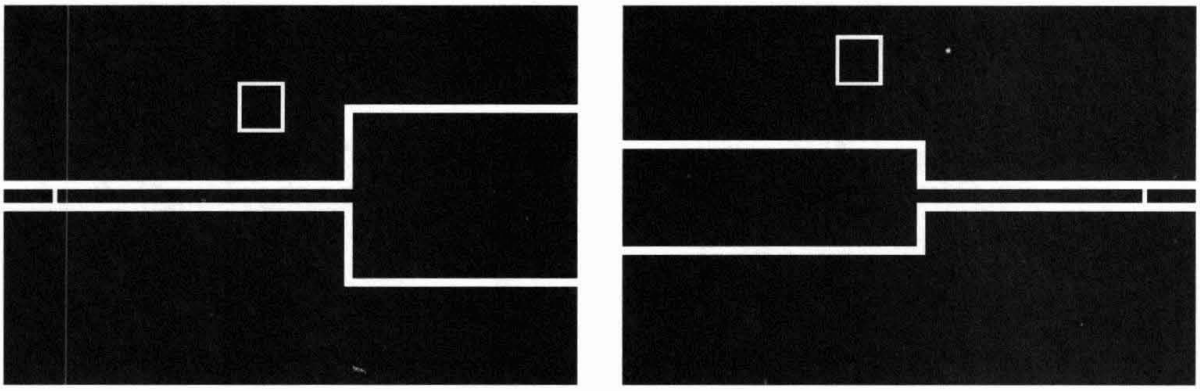


Parts Layout (not to scale)



Test Circuit Schematic for f = 960 MHz

DUT	PTF 10052	
C1, C5	39 pF, Capacitor ATC 100 B	
C2	7.5 pF, Capacitor ATC 100 B	
C3	0.6–6.0 pF, Trimmer Capacitor, Johanson, 5701-PC	
C4	0.35–3.5 pF, Trimmer Capacitor, Johanson, 5801-PC	
C6, C8	51 pF, Capacitor ATC 100 B	
C7, C9	0.1 μF, 50 V, Capacitor, Digi-Key P4917-ND	
C10	100 μF, 50 V, Electrolytic Capacitor, Digi-Key P5276	
L1	4 Turn, #20 AWG, .120" I.D.	
R1	1 K, 1/4 W Resistor	
R2	10 K, 1/4 W Resistor	
ℓ1, ℓ4		Microstrip 50 Ω
ℓ2	0.185 λ 960 MHz	Microstrip 5.70 Ω
ℓ3	0.240 λ 960 MHz	Microstrip 9.30 Ω
Circuit Board	.028" Dielectric Thickness, ε_r = 4.0, AlliedSignal, G200, 2 oz. copper	



Artwork (1 inch *)*

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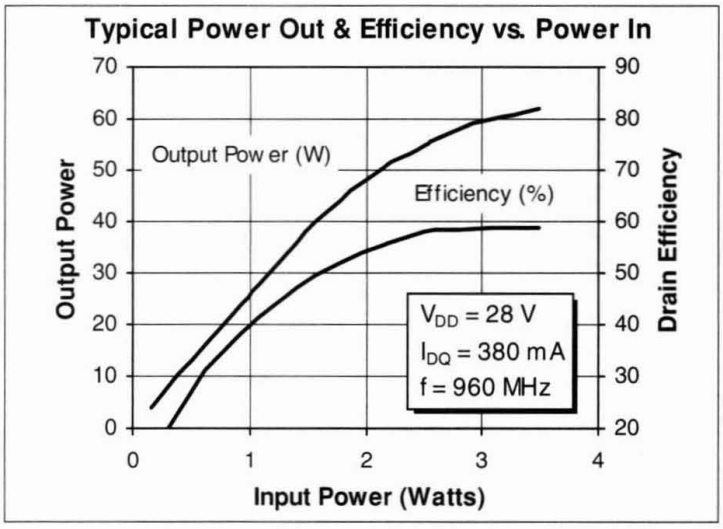
PTF 10015
50 Watts, 300–960 MHz
GOLDMOS™ Field Effect Transistor

Description

The PTF 10015 is a 50 Watt LDMOS FET intended for large signal amplifier applications from 300 to 960 MHz. It operates at 55% efficiency and 13.0 dB of gain. Nitride surface passivation and full gold metallization are used to ensure excellent device lifetime and reliability.

Features

- **Performance at 960 MHz, 28 Volts**
  - **Output Power = 50 Watts**
  - **Power Gain = 13.0 dB Typ, 12.0 dB Min**
  - **Efficiency = 55% Typ**
- **Full Gold Metallization**
- **Silicon Nitride Passivated**
- **Excellent Thermal Stability**
- **Back Side Common Source**
- **100% lot traceability**
- **Available in Package 20222 as PTF 10031**



Package
20235

Package
20222

Maximum Ratings

Parameter	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	65	Vdc
Gate-Source Voltage	V_{GS}	±20	Vdc
Operating Junction Temperature	T_J	200	°C
Total Device Dissipation Above 25°C derate by	P_D	175 1.0	Watts W/°C
Storage Temperature Range	T_{STG}	-65 to +150	°C
Thermal Resistance (T_C = 70°C)	$R_{\theta JC}$	1.0	°C/W

All published data is at T_C = 25°C unless otherwise indicated.

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PTF 10015

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Electrical Characteristics (100% Tested)

Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 25 mA	$V_{(BR)DSS}$	65	—	—	Volts
Drain-Source Leakage Current	V_{DS} = 28 V, V_{GS} = 0 V	I_{DSS}	—	—	1.0	mA
Gate Threshold Voltage	V_{DS} = 10 V, I_D = 75 mA	$V_{GS(th)}$	3.0	—	5.0	Volts
Forward Transconductance	V_{DS} = 10 V, I_D = 3 A	g_{fs}	2.0	2.8	—	Siemens

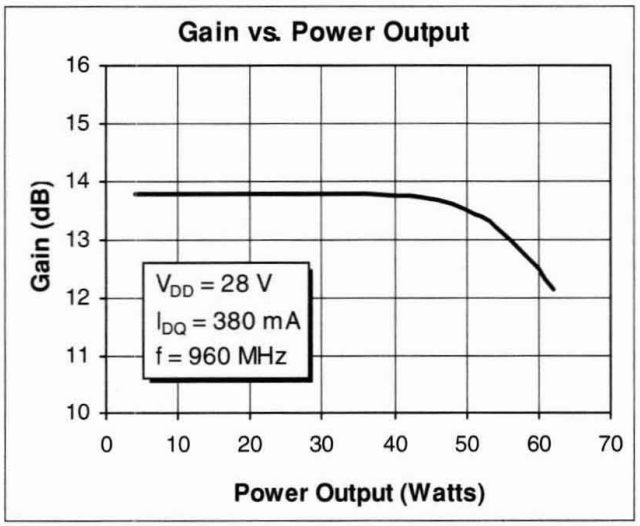
RF Specifications (100% Tested)

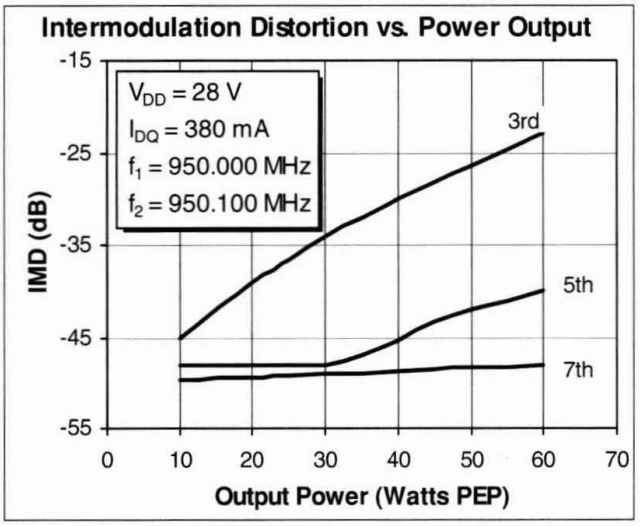
Characteristic	Symbol	Min	Typ	Max	Units
Common Source Power Gain (V_{DD} = 28 V, P_{OUT} = 50 W, I_{DQ} = 380 mA, f = 960 MHz)	G_{ps}	12.0	13.0	—	dB
Power Output at 1 dB Compression (V_{DD} = 28 V, I_{DQ} = 380 mA, f = 960 MHz)	P-1dB	50	—	—	Watts
Drain Efficiency (V_{DD} = 28 V, P_{OUT} = 50 W, I_{DQ} = 380 mA, f = 960 MHz)	η	50	55	—	%
Load Mismatch Tolerance (V_{DD} = 28 V, P_{OUT} = 50 W, I_{DQ} = 380 mA, f = 960 MHz— all phase angles at frequency of test)	Ψ	—	—	10:1	—

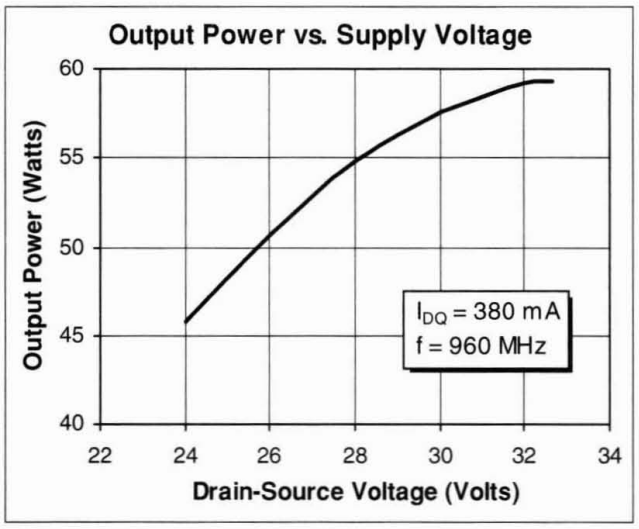
GOLDMOS™

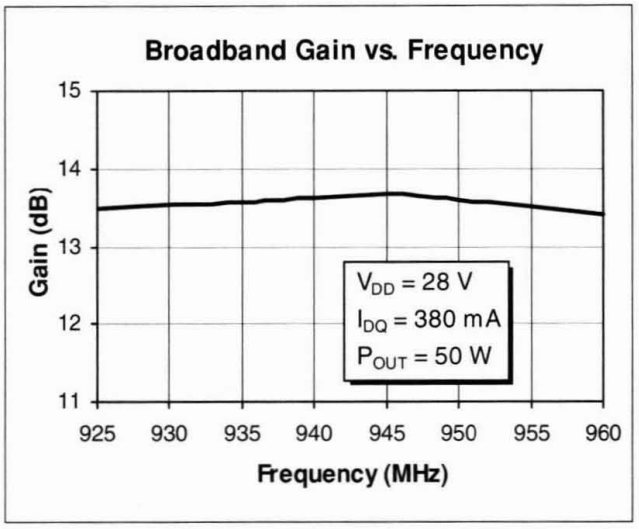
3

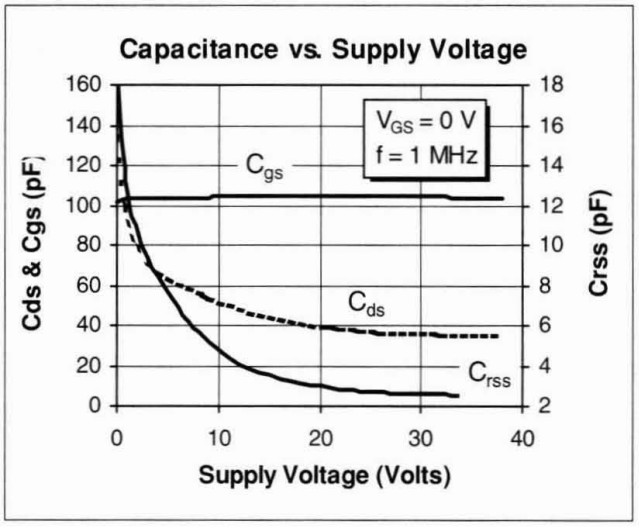
Typical Performance

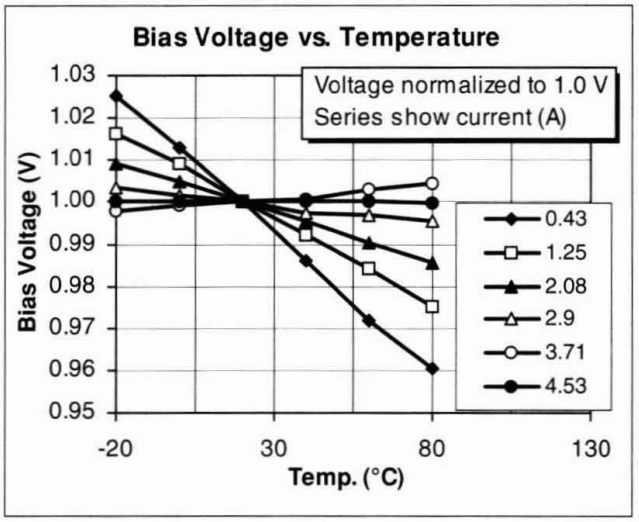






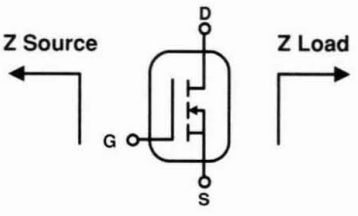




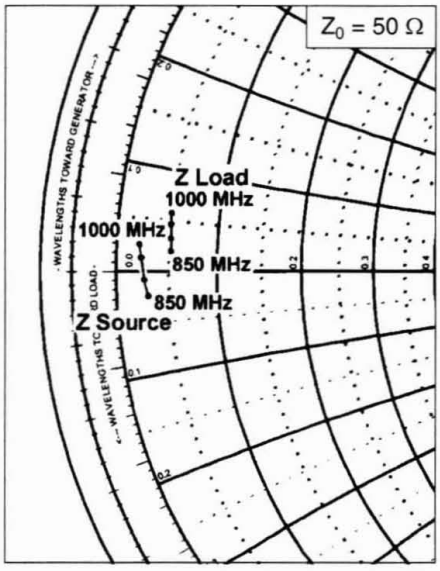


Impedance Data (circuit optimized at 960 MHz)

V_{DD} = 28 V, P_{OUT} = 50 W, I_{DQ} = 380 mA



Frequency	Z Source Ω		Z Load Ω	
MHz	R	jX	R	jX
850	1.38	-1.22	2.50	1.00
900	1.20	-0.44	2.45	1.65
950	1.08	+0.67	2.40	2.33
1000	0.96	+1.30	2.40	2.90

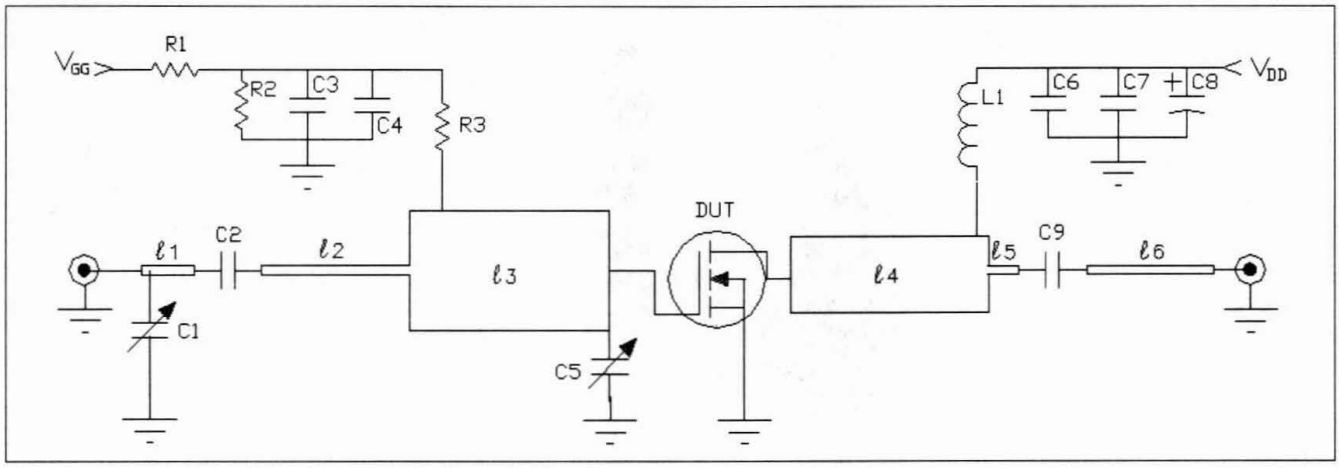


Typical Scattering Parameters

(V_{DS} = 28 V, I_D = 1.0 A)

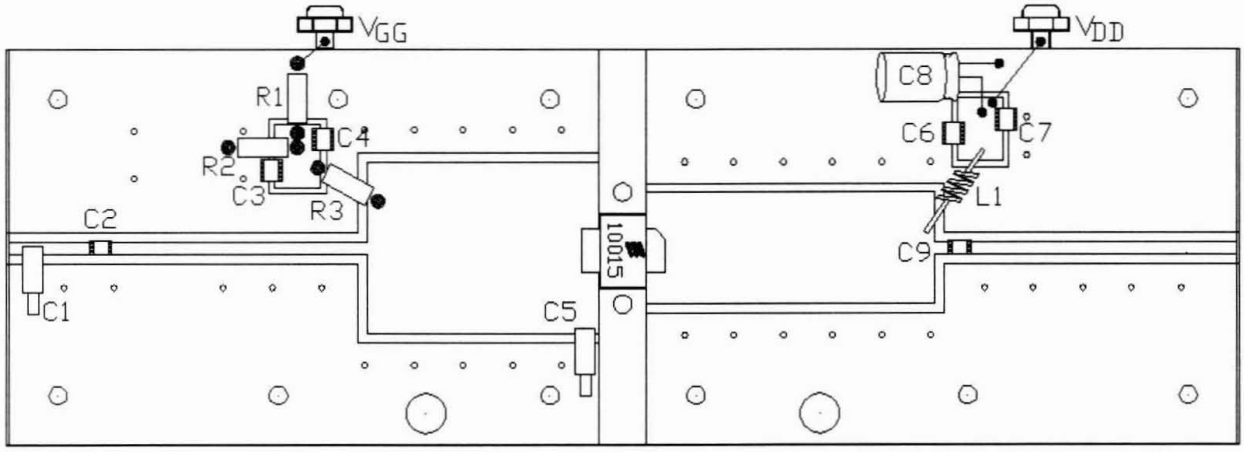
f	S11		S21		S12		S22	
(MHz)	Mag	Ang	Mag	Ang	Mag	Ang	Mag	Ang
40	0.883	-153	33.0	93	0.014	3	0.527	-143
60	0.878	-160	21.8	85	0.013	1	0.533	-148
80	0.876	-163	16.1	80	0.012	-6	0.553	-150
100	0.884	-164	12.8	76	0.012	-13	0.574	-148
150	0.904	-165	8.21	65	0.011	-18	0.638	-148
200	0.915	-165	5.67	58	0.010	-23	0.694	-149
250	0.934	-164	4.36	51	0.010	-31	0.769	-148
300	0.947	-164	3.41	45	0.010	-31	0.792	-149
350	0.962	-163	2.78	41	0.008	-28	0.837	-150
400	0.975	-163	2.30	36	0.008	-33	0.873	-151
450	0.974	-163	1.90	33	0.006	-36	0.874	-151
500	0.977	-163	1.65	30	0.006	-52	0.912	-152
550	0.979	-164	1.44	27	0.005	-46	0.916	-154
600	0.985	-164	1.28	26	0.004	-53	0.925	-154
650	0.981	-165	1.14	22	0.003	-27	0.933	-156
700	0.980	-166	1.01	21	0.004	-18	0.933	-157
750	0.975	-167	0.924	19	0.003	-13	0.936	-158
800	0.973	-168	0.809	16	0.001	14	0.946	-160
850	0.972	-170	0.749	14	0.003	-1	0.939	-160
900	0.969	-171	0.656	12	0.003	30	0.946	-162
950	0.966	-173	0.609	14	0.002	53	0.948	-164
1000	0.969	-174	0.564	8	0.003	59	0.945	-164
1050	0.969	-176	0.526	3	0.004	56	0.949	-167
1100	0.970	-177	0.450	6	0.004	69	0.955	-167
1150	0.970	-178	0.405	1	0.005	57	0.953	-168
1200	0.970	-179	0.383	4	0.005	65	0.952	-169
1250	0.971	180	0.351	-5	0.005	56	0.959	-170
1300	0.971	179	0.330	-5	0.005	61	0.957	-170
1350	0.973	179	0.308	-5	0.005	52	0.963	-171
1400	0.973	179	0.255	-3	0.006	59	0.965	-171
1450	0.972	179	0.219	5	0.006	58	0.965	-171
1500	0.965	179	0.210	-8	0.006	62	0.957	-172

Test Circuit



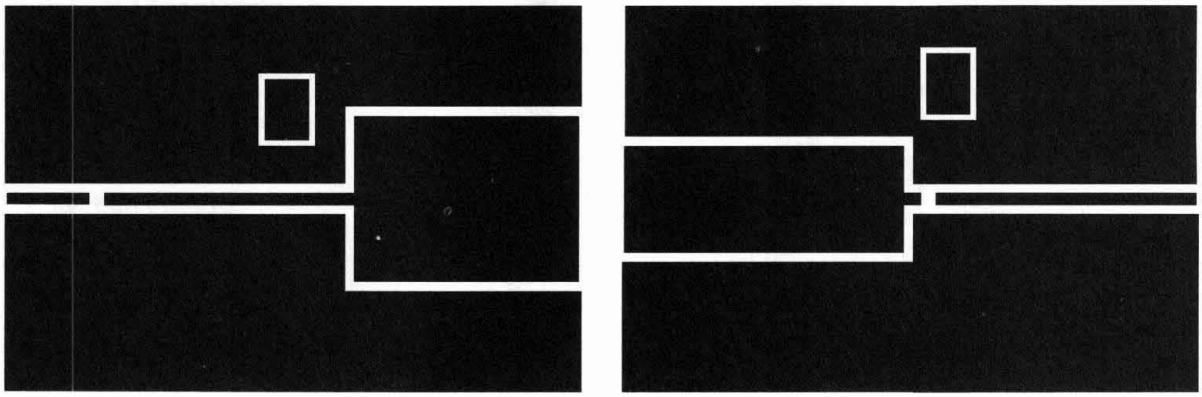
Test Circuit Schematic for f = 960 MHz

DUT	PTF 10015	
ℓ1	.140 λ 960 MHz	Microstrip 50 Ω
ℓ2	.270 λ 960 MHz	Microstrip 50 Ω
ℓ3	.185 λ 960 MHz	Microstrip 6.2 Ω
ℓ4	.225 λ 960 MHz	Microstrip 11.0 Ω
ℓ5	.040 λ 960 MHz	Microstrip 50 Ω
ℓ6	.330 λ 960 MHz	Microstrip 50 Ω
C1, C5	0.3-3.5 pF, Variable Capacitor, Johanson	
C2, C4, C6, C9	36 pF, Capacitor ATC 100 B	
C3	0.01 µF, Capacitor ATC 10,000 B	
C7	0.1 µF, 50 V, Capacitor Digi-Key P4917-ND	
C8	100 µF, 50 V, Electrolytic Capacitor, Digi-Key P5276	
L1	4 Turn, #20 AWG, .120" I.D.	
R1, R2, R3	220 Ω, 1/4 W Resistor	
Circuit Board	.028" Dielectric Thickness, ε_r = 4.0, AlliedSignal, G200, 2 oz. copper	



Placement Diagram (not to scale)

Test Circuit



Artwork (1 inch *)*

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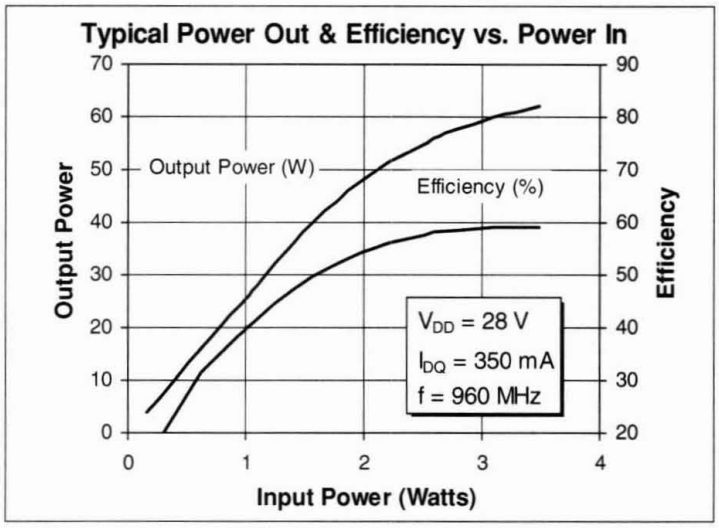
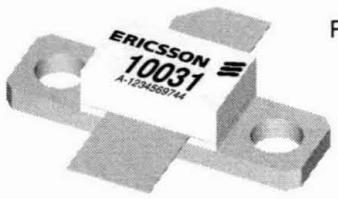
PTF 10031
50 Watts, 1.0 GHz
GOLDMOS™ Field Effect Transistor

Description

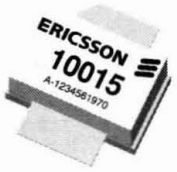
The PTF 10031 is a 50 Watt LDMOS FET intended for large signal amplifier applications to 1.0 GHz. It operates at 55% efficiency and 13.0 dB of gain. Nitride surface passivation and full gold metallization ensure excellent device lifetime and reliability.

- **Performance at 960 MHz, 28 Volts**
  - **Output Power = 50 Watts**
  - **Power Gain = 13.0 dB Typ**
  - **Efficiency = 55% Typ**
- **Full Gold Metallization**
- **Silicon Nitride Passivated**
- **Excellent Thermal Stability**
- **Back Side Common Source**
- **Available in Package 20235 as PTF 10015**
- **100% Lot Traceability**





Package
20222



Package
20235

Maximum Ratings

Parameter	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	65	Vdc
Gate-Source Voltage	V_{GS}	±20	Vdc
Operating Junction Temperature	T_J	200	°C
Total Device Dissipation T_{CASE} = 25°C Above 25°C derate by	P_D	175 1.0	Watts W/°C
Storage Temperature Range	T_{STG}	-65 to 150	°C
Thermal Resistance (T_{CASE} = 70°C)	$R_{\theta JC}$	1.0	°C/W

All published data at T_{CASE} = 25°C unless otherwise indicated.

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Electrical Characteristics (100% Tested)

Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 25 mA	$V_{(BR)DSS}$	65	—	—	Volts
Drain-Source Leakage Current	V_{DS} = 28 V, V_{GS} = 0 V	I_{DSS}	—	—	1.0	mA
Gate Threshold Voltage	V_{DS} = 10 V, I_D = 75 mA	$V_{GS(th)}$	3.0	—	5.0	Volts
Forward Transconductance	V_{DS} = 10 V, I_D = 3 A	g_{fs}	—	2.8	—	Siemens

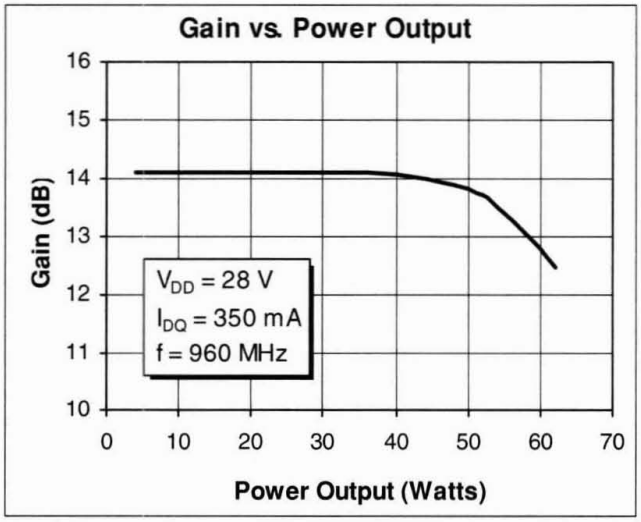
RF Specifications (100% Tested)

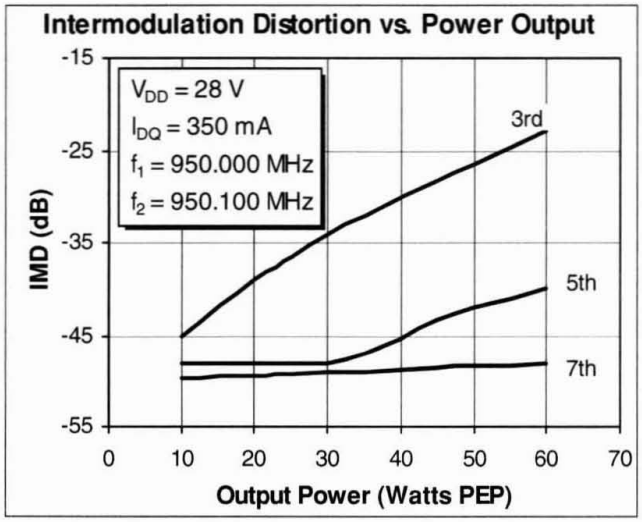
Characteristic	Symbol	Min	Typ	Max	Units
Common Source Power Gain (V_{DD} = 28 V, P_{OUT} = 50 W, I_{DQ} = 350 mA, f = 960 MHz)	G_{ps}	12.0	13.0	—	dB
Power Output at 1 dB Compression (V_{DD} = 28 V, I_{DQ} = 350 mA, f = 960 MHz)	P-1dB	50	55	—	Watts
Drain Efficiency (V_{DD} = 28 V, P_{OUT} = 50 W, I_{DQ} = 350 mA, f = 960 MHz)	η	50	55	—	%
Load Mismatch Tolerance (V_{DD} = 28 V, P_{OUT} = 50 W, I_{DQ} = 350 mA, f = 960 MHz— all phase angles at frequency of test)	Ψ	—	—	10:1	—

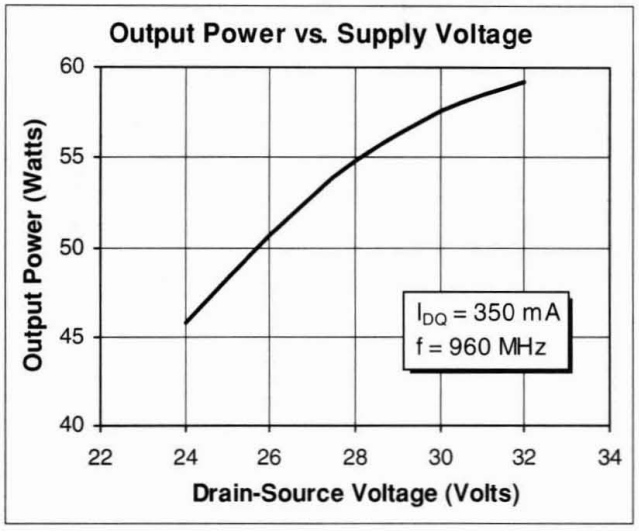
GOLDMOS™

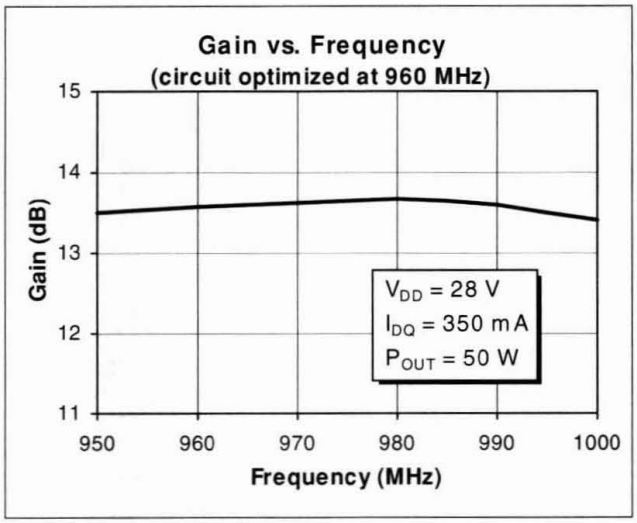
3

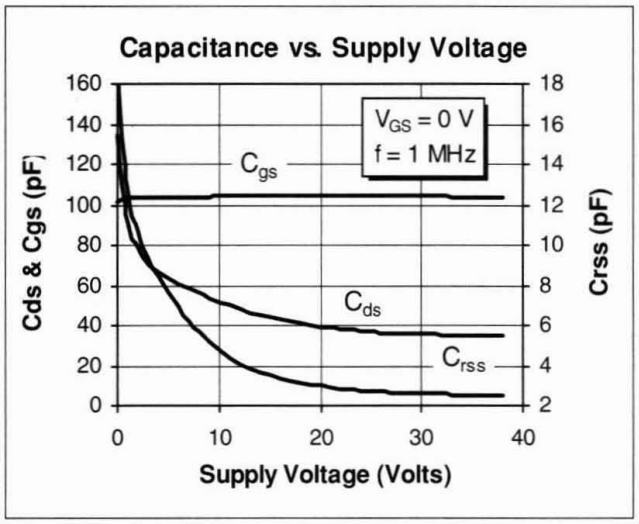
Typical Performance

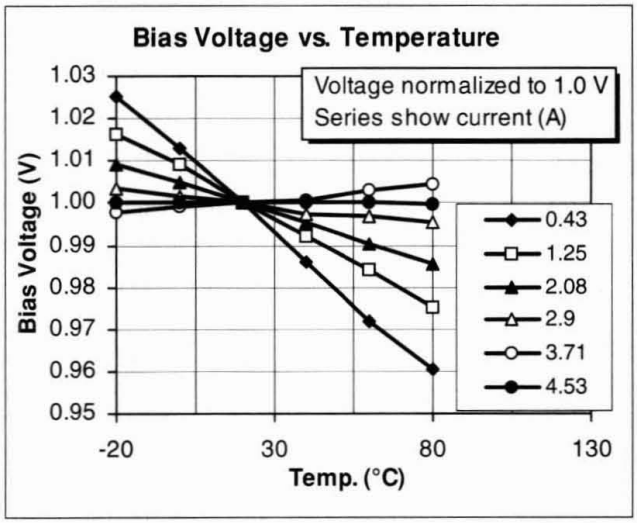






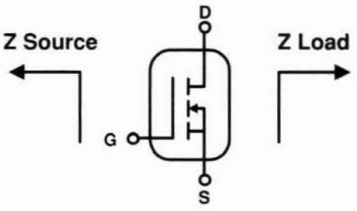


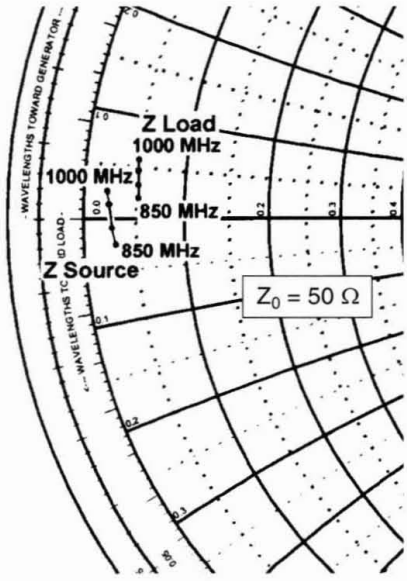




Impedance Data (circuit optimized at 960 MHz)

V_{DD} = 28 V, P_{OUT} = 50 W, I_{DQ} = 350 mA





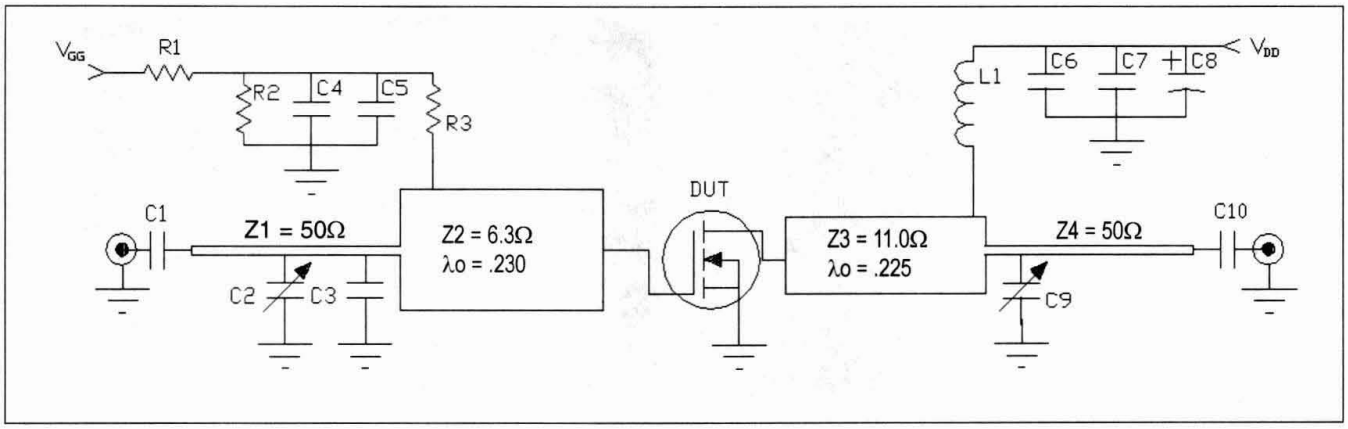
Frequency	Z Source Ω		Z Load Ω	
MHz	R	jX	R	jX
850	1.38	-1.22	2.50	1.00
900	1.20	-0.44	2.45	1.65
950	1.08	+0.67	2.40	2.33
1000	0.96	+1.30	2.40	2.90

Typical Scattering Parameters

(V_{DS} = 28 V, I_D = 1.0 A)

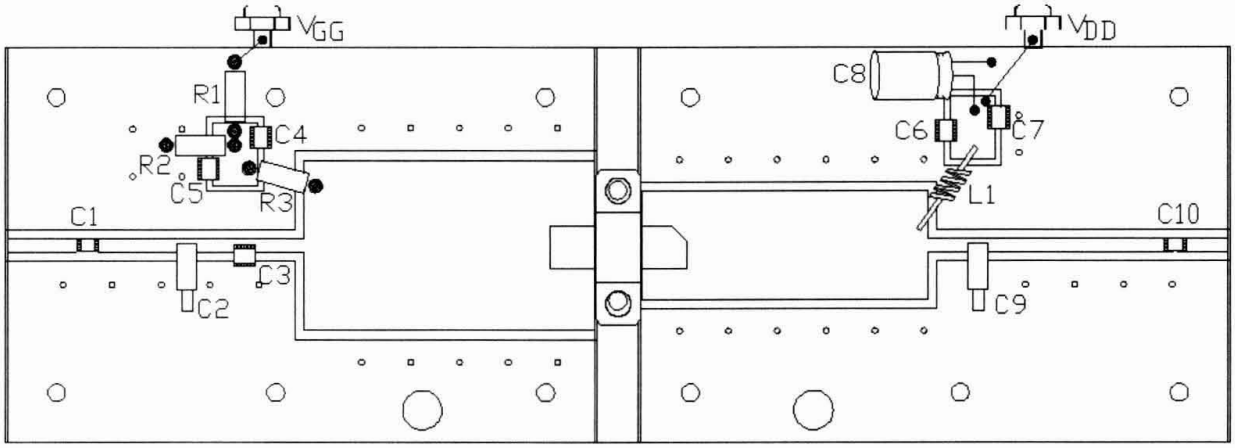
f	S11		S21		S12		S22	
(MHz)	Mag	Ang	Mag	Ang	Mag	Ang	Mag	Ang
40	0.883	-153	33.0	93	0.014	3	0.527	-143
60	0.878	-160	21.8	85	0.013	1	0.533	-148
80	0.876	-163	16.1	80	0.012	-6	0.553	-150
100	0.884	-164	12.8	76	0.012	-13	0.574	-148
150	0.904	-165	8.21	65	0.011	-18	0.638	-148
200	0.915	-165	5.67	58	0.010	-23	0.694	-149
250	0.934	-164	4.36	51	0.010	-31	0.769	-148
300	0.947	-164	3.41	45	0.010	-31	0.792	-149
350	0.962	-163	2.78	41	0.008	-28	0.837	-150
400	0.975	-163	2.30	36	0.008	-33	0.873	-151
450	0.974	-163	1.90	33	0.006	-36	0.874	-151
500	0.977	-163	1.65	30	0.006	-52	0.912	-152
550	0.979	-164	1.44	27	0.005	-46	0.916	-154
600	0.985	-164	1.28	26	0.004	-53	0.925	-154
650	0.981	-165	1.14	22	0.003	-27	0.933	-156
700	0.980	-166	1.01	21	0.004	-18	0.933	-157
750	0.975	-167	0.924	19	0.003	-13	0.936	-158
800	0.973	-168	0.809	16	0.001	14	0.946	-160
850	0.972	-170	0.749	14	0.003	-1	0.939	-160
900	0.969	-171	0.656	12	0.003	30	0.946	-162
950	0.966	-173	0.609	14	0.002	53	0.948	-164
1000	0.969	-174	0.564	8	0.003	59	0.945	-164
1050	0.969	-176	0.526	3	0.004	56	0.949	-167
1100	0.970	-177	0.450	6	0.004	69	0.955	-167
1150	0.970	-178	0.405	1	0.005	57	0.953	-168
1200	0.970	-179	0.383	4	0.005	65	0.952	-169
1250	0.971	180	0.351	-5	0.005	56	0.959	-170
1300	0.971	179	0.330	-5	0.005	61	0.957	-170
1350	0.973	179	0.308	-5	0.005	52	0.963	-171
1400	0.973	179	0.255	-3	0.006	59	0.965	-171
1450	0.972	179	0.219	5	0.006	58	0.965	-171
1500	0.965	179	0.210	-8	0.006	62	0.957	-172

Test Circuit



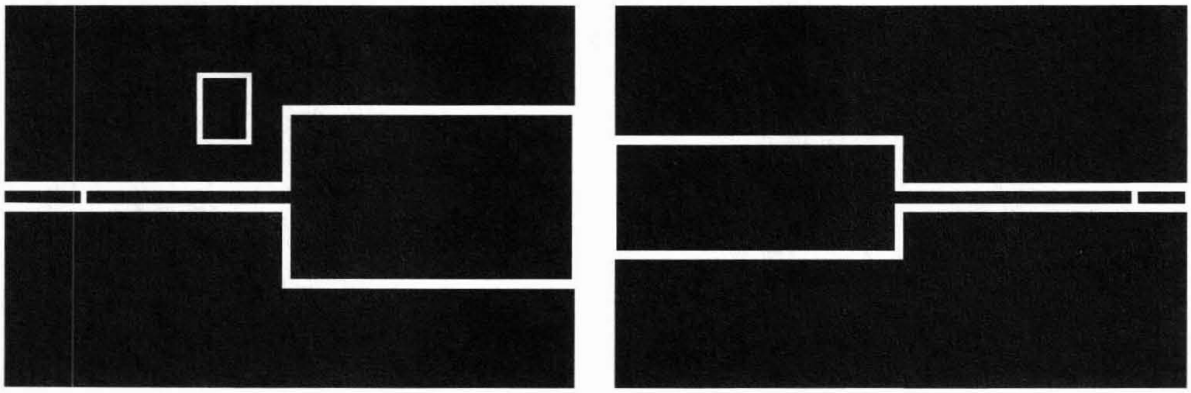
Test Circuit Schematic for f = 960 MHz

DUT	PTF 10031
C1, C10	36 pF, Capacitor ATC 100 B
C2, C9	0.3-3.5 pF, Variable Capacitor, Johanson
C3	5.6 pF, Capacitor ATC 100 B
C4	0.01 μF, Capacitor ATC 10,000 B
C5, C6	51 pF, Capacitor ATC 100 B
C7	0.1 μF, 50 V, Capacitor Digi-Key P4917-ND
C8	100 μF, 50 V, Electrolytic Capacitor, Digi-Key P5276
L1	4 Turn, #20 AWG, .120" I.D.
R1, R2	560 Ω, 1/4 W Resistor
R3	330 Ω, 1/4 W Resistor
Circuit Board	.028" Dielectric Thickness, ε_r = 4.0, AlliedSignal, G200, 2 oz. copper



Placement Diagram

Test Circuit



Artwork (1 inch *)*

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EUS/KR 1301-PTF 10031 Uen Rev. B 12-14-98

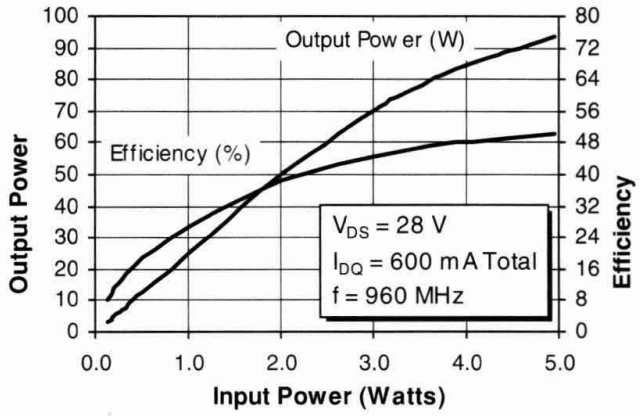
PTF 10009
85 Watts, 1.0 GHz
GOLDMOS™ Field Effect Transistor

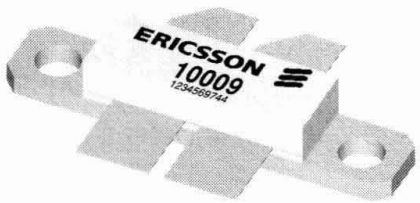
Description

The PTF 10009 is an 85 Watt LDMOS FET intended for large signal amplifier applications to 1.0 GHz. It operates at 50% efficiency and 13.0 dB of gain. Nitride surface passivation and full gold metallization are used to ensure excellent device lifetime and reliability.

- **Performance at 960 MHz, 28 Volts**
  - **Output Power = 85 Watts**
  - **Power Gain = 13.0 dB Typ**
  - **Efficiency = 50% Typ**
- **Full Gold Metallization**
- **Silicon Nitride Passivated**
- **Excellent Thermal Stability**
- **100% lot traceability**

Typical Output Power and Efficiency vs. Input Power





Package 20230

Maximum Ratings

Parameter	Symbol	Value	Unit
Drain-Source Voltage (1)	V_{DSS}	65	Vdc
Gate-Source Voltage (1)	V_{GS}	±20	Vdc
Operating Junction Temperature	T_J	200	°C
Total Device Dissipation Above 25°C derate by	P_D	270 1.54	Watts W/°C
Storage Temperature Range	T_{STG}	-65 to 150	°C
Thermal Resistance (T_{CASE} = 70°C)	$R_{\theta JC}$	0.65	°C/W

(1)per side

All published data at T_{CASE} = 25°C unless otherwise indicated.

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Electrical Characteristics (100% Tested—characteristics, conditions and limits shown per side)

Characteristic (per side)	Conditions	Symbol	Min	Typ	Max	Units
Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 25 mA	$V_{(BR)DSS}$	65	—	—	Volts
Drain-Source Leakage Current	V_{DS} = 28 V, V_{GS} = 0 V	I_{DSS}	—	—	1.0	mA
Gate Threshold Voltage	V_{DS} = 10 V, I_D = 75 mA	$V_{GS(th)}$	3.0	—	5.0	Volts
Forward Transconductance	V_{DS} = 10 V, I_D = 3 A	g_{fs}	—	2.8	—	Siemens

Dynamic Characteristics

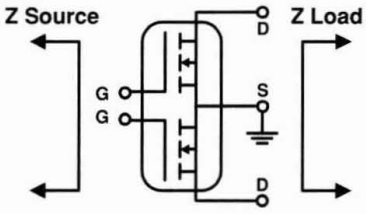
Characteristic (per side)	Symbol	Min	Typ	Max	Units
Input Capacitance (V_{DS} = 28 V, V_{GS} = 0 V, f = 1 MHz)	C_{iss}	—	90	—	pF
Output Capacitance (V_{DS} = 28 V, V_{GS} = 0 V, f = 1 MHz)	C_{oss}	—	36	—	pF
Reverse Transfer Capacitance (V_{DS} = 28 V, V_{GS} = 0 V, f = 1 MHz)	C_{rss}	—	1.9	—	pF

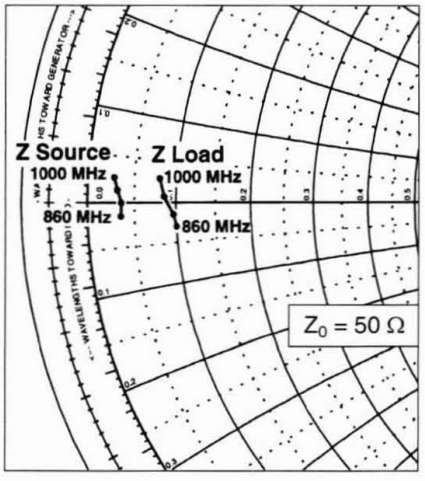
RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{DD} = 28 V, P_{out} = 85 W, I_{DQ} = 600 mA, f = 960 MHz)	G_{ps}	12.0	13.0	—	dB
Drain Efficiency (V_{DD} = 28 V, P_{out} = 85 W, I_{DQ} = 600 mA, f = 960 MHz)	η	47	50	—	%
Load Mismatch Tolerance (V_{DD} = 28 V, P_{out} = 85 W, I_{DQ} = 600 mA, f = 960 MHz— all phase angles at frequency of test)	Ψ	—	—	5:1	—

Impedance Data (data shown for fixed-tuned broadband circuit)

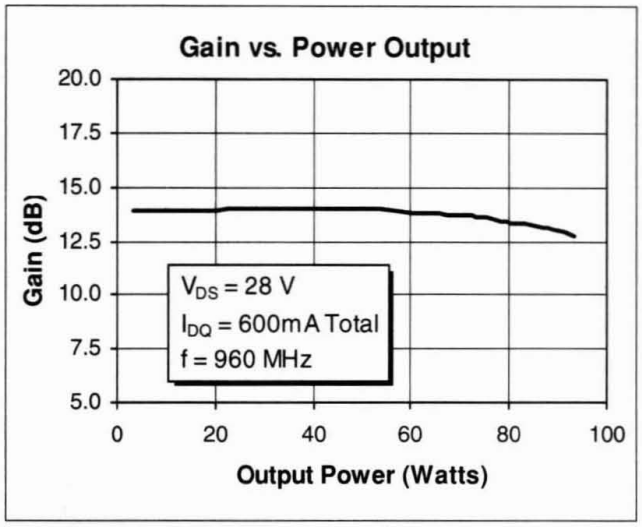
(V_{DD} = 28 V, P_{out} = 85 W, I_{DQ} = 600 mA)

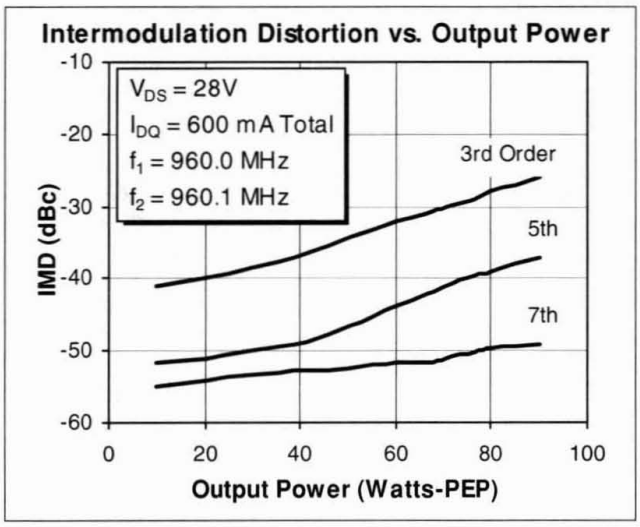


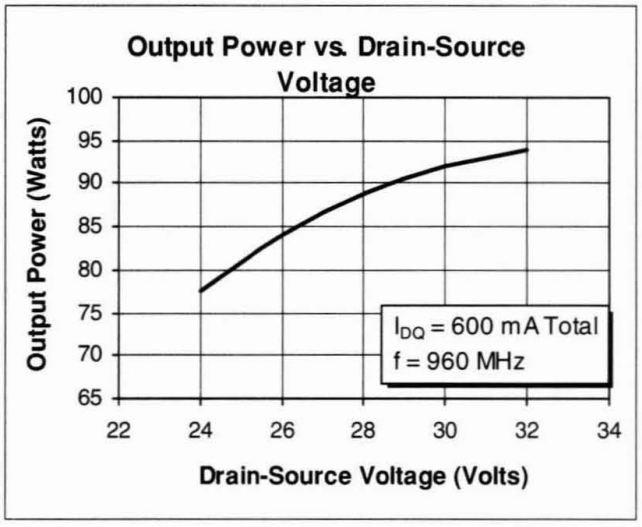


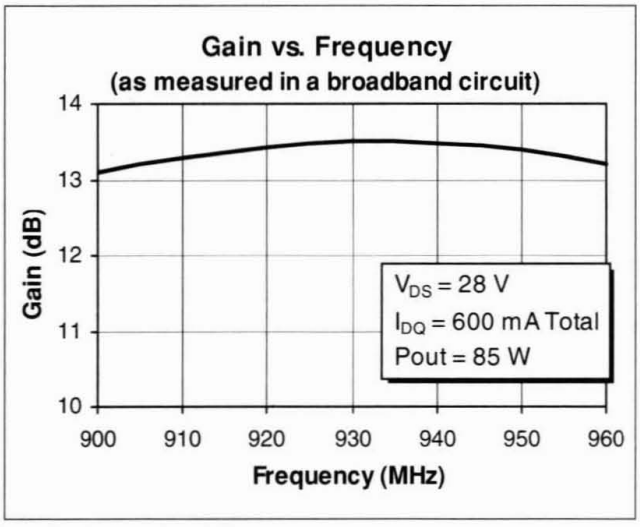
Frequency	Z Source Ω		Z Load Ω	
MHz	R	jX	R	jX
860	1.76	-0.78	5.00	-1.50
900	1.80	-0.05	4.80	-0.78
960	1.58	0.69	4.24	0.36
1000	1.39	1.35	3.95	1.41

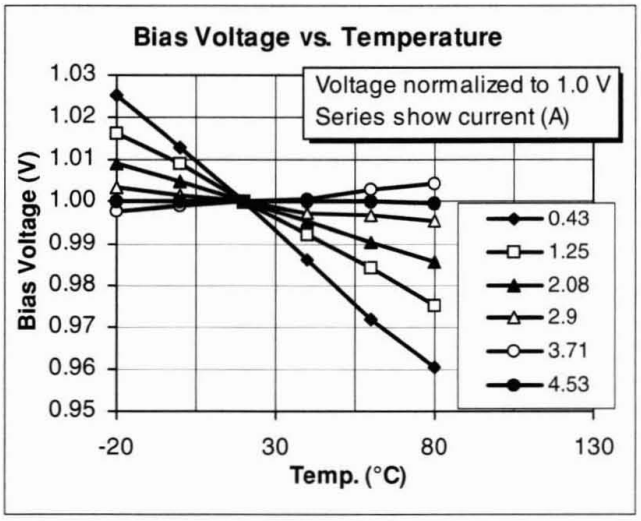
Typical Performance









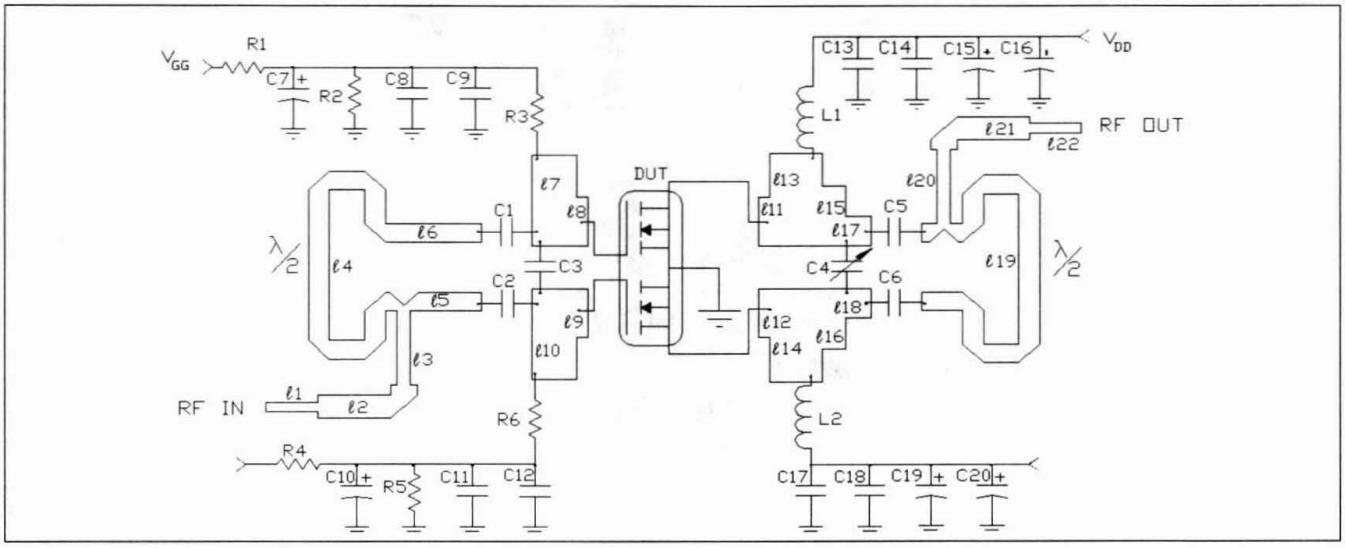


Typical Scattering Parameters

(V_{DS} = 28 V, I_D = 1.0 A per side)

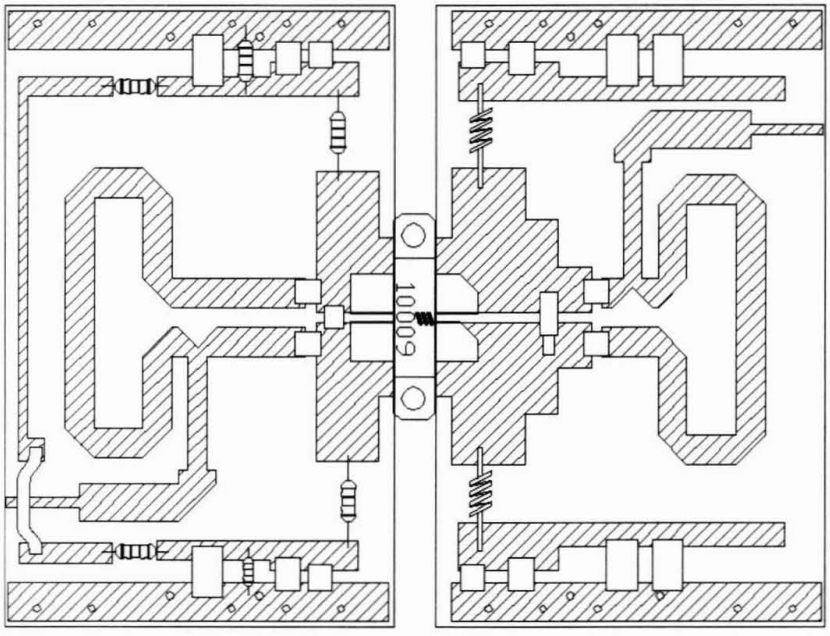
f	S11		S21		S12		S22	
(MHz)	Mag	Ang	Mag	Ang	Mag	Ang	Mag	Ang
40	0.883	-153	33.0	93	0.014	3	0.527	-143
60	0.878	-160	21.8	85	0.013	1	0.533	-148
80	0.876	-163	16.1	80	0.012	-6	0.553	-150
100	0.884	-164	12.8	76	0.012	-13	0.574	-148
150	0.904	-165	8.21	65	0.011	-18	0.638	-148
200	0.915	-165	5.67	58	0.010	-23	0.694	-149
250	0.934	-164	4.36	51	0.010	-31	0.769	-148
300	0.947	-164	3.41	45	0.010	-31	0.792	-149
350	0.962	-163	2.78	41	0.008	-28	0.837	-150
400	0.975	-163	2.30	36	0.008	-33	0.873	-151
450	0.974	-163	1.90	33	0.006	-36	0.874	-151
500	0.977	-163	1.65	30	0.006	-52	0.912	-152
550	0.979	-164	1.44	27	0.005	-46	0.916	-154
600	0.985	-164	1.28	26	0.004	-53	0.925	-154
650	0.981	-165	1.14	22	0.003	-27	0.933	-156
700	0.980	-166	1.01	21	0.004	-18	0.933	-157
750	0.975	-167	0.924	19	0.003	-13	0.936	-158
800	0.973	-168	0.809	16	0.001	14	0.946	-160
850	0.972	-170	0.749	14	0.003	-1	0.939	-160
900	0.969	-171	0.656	12	0.003	30	0.946	-162
950	0.966	-173	0.609	14	0.002	53	0.948	-164
1000	0.969	-174	0.564	8	0.003	59	0.945	-164
1050	0.969	-176	0.526	3	0.004	56	0.949	-167
1100	0.970	-177	0.450	6	0.004	69	0.955	-167
1150	0.970	-178	0.405	1	0.005	57	0.953	-168
1200	0.970	-179	0.383	4	0.005	65	0.952	-169
1250	0.971	180	0.351	-5	0.005	56	0.959	-170
1300	0.971	179	0.330	-5	0.005	61	0.957	-170
1350	0.973	179	0.308	-5	0.005	52	0.963	-171
1400	0.973	179	0.255	-3	0.006	59	0.965	-171
1450	0.972	179	0.219	5	0.006	58	0.965	-171
1500	0.965	179	0.210	-8	0.006	62	0.957	-172

Test Circuit

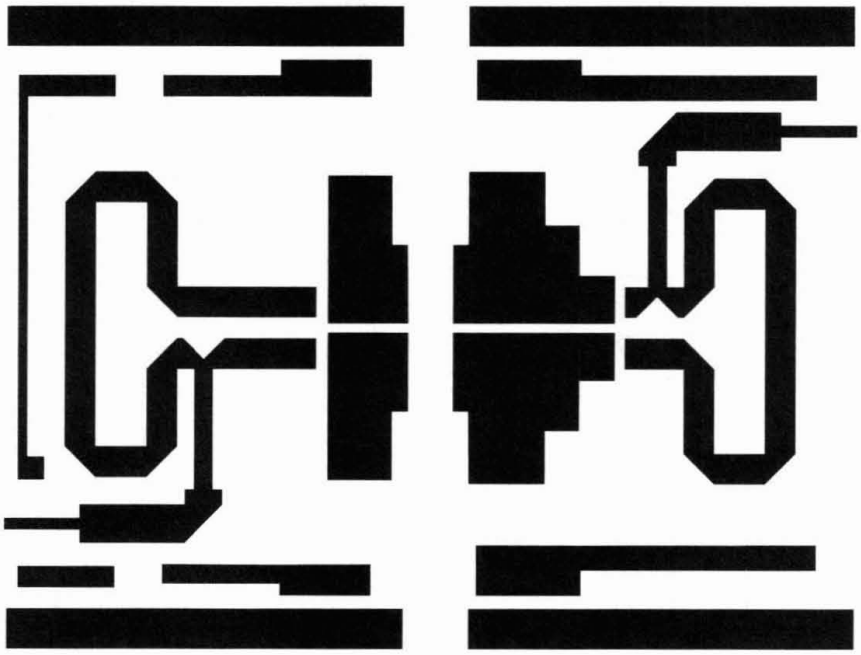


Schematic for f = 960 MHz

DUT	10009
C1-2, C5-6, C9, C12-13, C17	33 pF, Capacitor ATC 100 B
C3	11 pF, Capacitor ATC 100 B
C4	6.0 pF, Variable Capacitor, JMC 5701
C7, C10	10 µF, +10 V Electrolytic Capacitor
C8, C11, C14, C18	0.01 µF, Capacitor ATC 100 B
C15, C16, C19, C20	10 µF, +30 V Electrolytic Capacitor
L1. L2	4 Turn, #20 AWG, .120" I.D.
R1, R2, R4, R5	1.0 K, Ω Resistor
R3, R6	5.1 K, 1/4 Ω Resistor
ℓ1, ℓ22	50 Ω, .030 λ
ℓ2, ℓ21	20 Ω, .080 λ
ℓ3, ℓ20	32 Ω, .191 λ
ℓ4, ℓ19	25 Ω, .500 λ
ℓ5, ℓ6	25 Ω, .091 λ
ℓ7, ℓ10	7 Ω, .056 λ
ℓ8, ℓ9	13.0 Ω, .017 λ
ℓ11, ℓ12	13.0 Ω, .017 λ
ℓ13, ℓ14	7.0 Ω, .064 λ
ℓ15, ℓ16	10.0 Ω, .029 λ
ℓ17, ℓ18	19.0 Ω, .028 λ
Circuit Board	.028" Dielectric Thickness, ε_r = 4.0, AlliedSignal, G200, 2 oz. copper



Parts Layout (not to scale)



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GOLDMOS™

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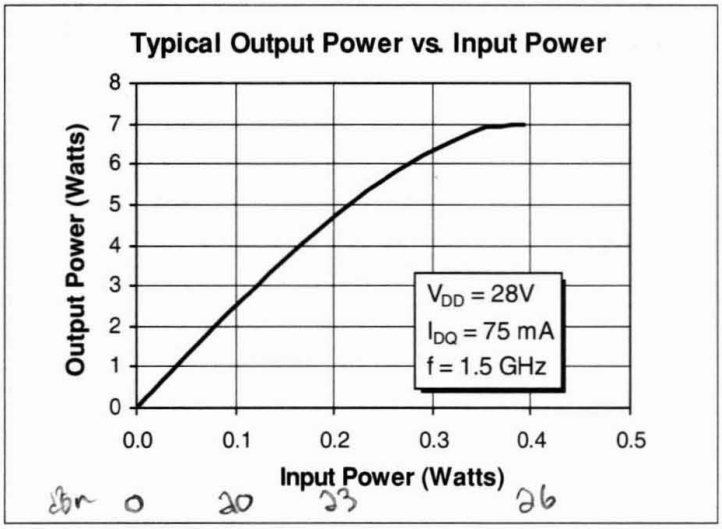
PTF 10111
6 Watts, 1.5 GHz
GOLDMOS™ Field Effect Transistor

Description

The PTF 10111 is a 6 watt LDMOS FET intended for large signal amplifier applications to 1.5 GHz. It operates @ 50% efficiency and 16 dB of gain. Nitride surface passivation and full gold metallization ensure excellent device lifetime and reliability.

- **Performance at 1.5 GHz, 28 Volts**
  - **Output Power = 6 Watts**
  - **Efficiency = 50% Typ**
  - **Power Gain = 16 dB Typ**
- **Full Gold Metallization**
- **Silicon Nitride Passivated**
- **100% Lot Traceability**



Package 20222

GOLDMOS™

3

Maximum Ratings

Parameter	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	65	Vdc
Gate-Source Voltage	V_{GS}	±20	Vdc
Operating Junction Temperature	T_J	200	°C
Total Device Dissipation at T_{flange} = 25°C Above 25°C derate by	P_D	36 0.208	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{flange} = 70°C)	$R_{\theta JC}$	4.8	°C/W

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PTF 10111

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Electrical Characteristics (100% Tested)

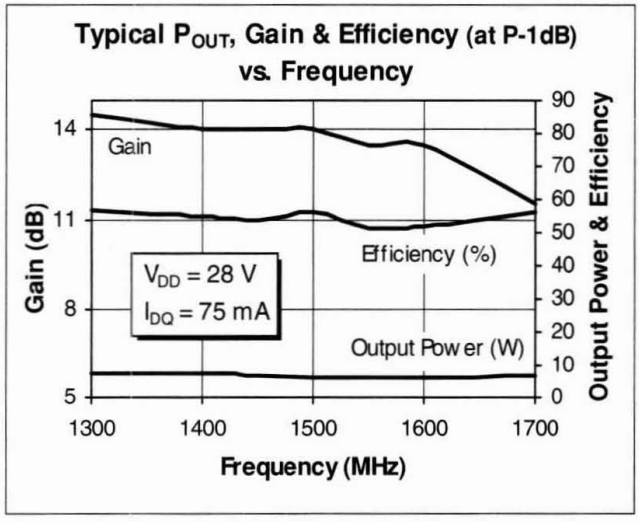
Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 40 mA	$V_{(BR)DSS}$	65	68	—	Volts
Drain-Source Leakage Current	V_{DS} = 28 V, V_{GS} = 0 V	I_{DSS}	—	—	1	mA
Gate Threshold Voltage	V_{DS} = 10 V, I_D = 75 mA	$V_{GS(th)}$	3.0	—	5.0	Volts
Forward Transconductance	V_{DS} = 10 V, I_D = 0.5 A	g_{fs}	—	0.2	—	Siemens

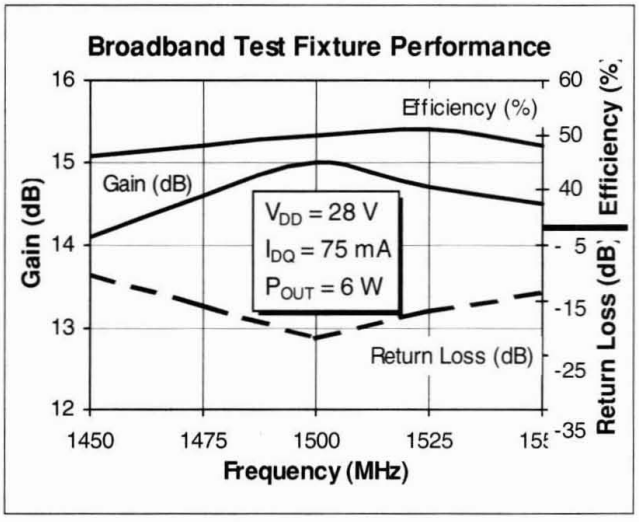
RF Specifications (100% Tested)

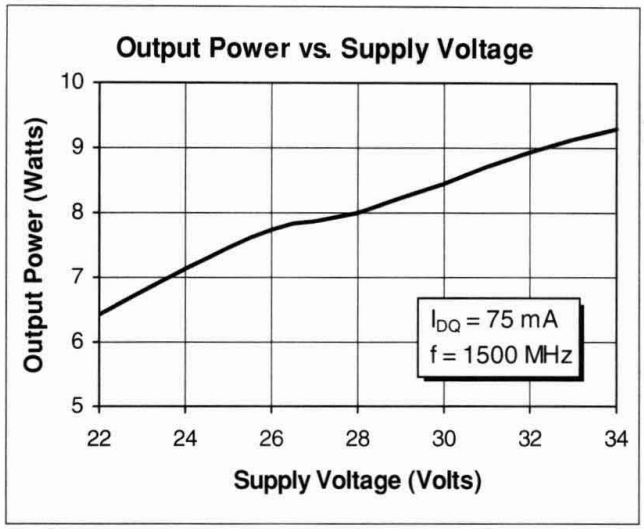
Characteristic	Symbol	Min	Typ	Max	Units
Common Source Power Gain (V_{DD} = 28 V, P_{OUT} = 6 W, I_{DQ} = 75 mA, f = 1.5 GHz)	G_{ps}	15.0	16	—	dB
Power Output at 1 dB Compressed (V_{DD} = 28 V, I_{DQ} = 75 mA, f = 1.5 GHz)	P-1dB	6	7	—	Watts
Drain Efficiency (V_{DD} = 28 V, P_{OUT} = 6 W, I_{DQ} = 75 mA, f = 1.5 GHz)	η_D	45	50	—	%
Load Mismatch Tolerance (V_{DD} = 28 V, P_{OUT} = 6 W, I_{DQ} = 75 mA, f = 1.5 GHz— all phase angles at frequency of test)	Ψ	—	—	30:1	—

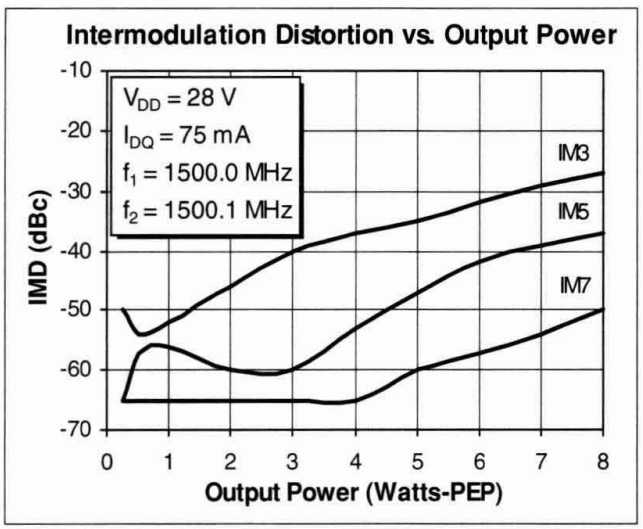
GOLDMOS™

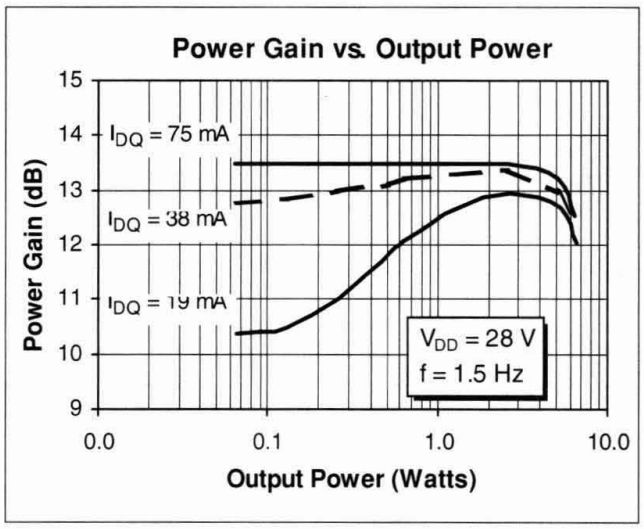
Typical Performance

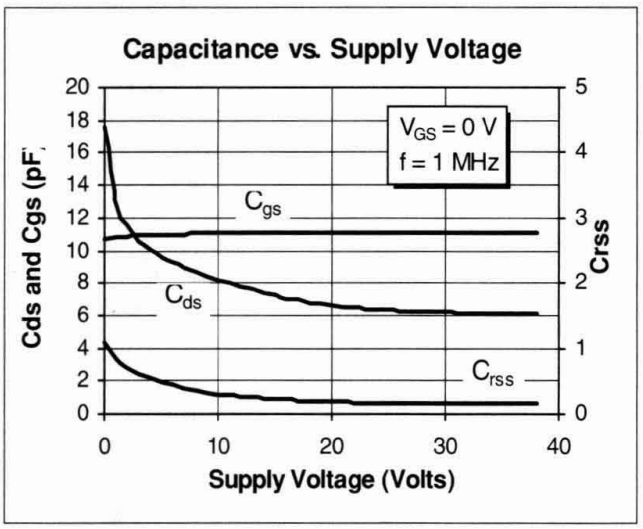


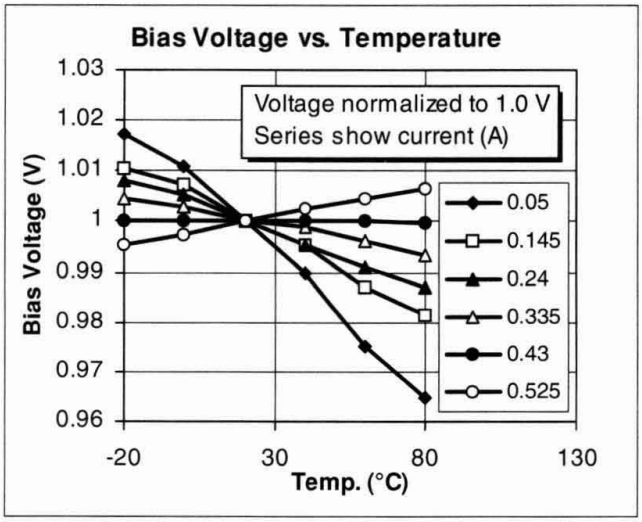



Output Power vs. Supply Voltage
Output Power (Watts)
Supply Voltage (Volts)
I_{DQ} = 75 mA
f = 1500 MHz


Intermodulation Distortion vs. Output Power
IMD (dBc)
Output Power (Watts-PEP)
V_{DD} = 28 V
I_{DQ} = 75 mA
f_1 = 1500.0 MHz
f_2 = 1500.1 MHz
IM3
IM5
IM7


Power Gain vs. Output Power
Power Gain (dB)
Output Power (Watts)
I_{DQ} = 75 mA
I_{DQ} = 38 mA
I_{DQ} = 19 mA
V_{DD} = 28 V
f = 1.5 Hz


Capacitance vs. Supply Voltage
Cds and Cgs (pF)
Crss
Supply Voltage (Volts)
V_{GS} = 0 V
f = 1 MHz
C_{gs}
C_{ds}
C_{rss}


Bias Voltage vs. Temperature
Bias Voltage (V)
Temp. (°C)
Voltage normalized to 1.0 V
Series show current (A)
0.05
0.145
0.24
0.335
0.43
0.525

PTF 10111

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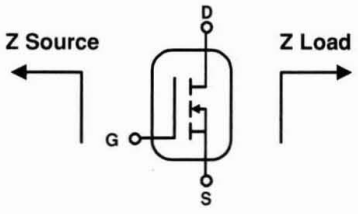
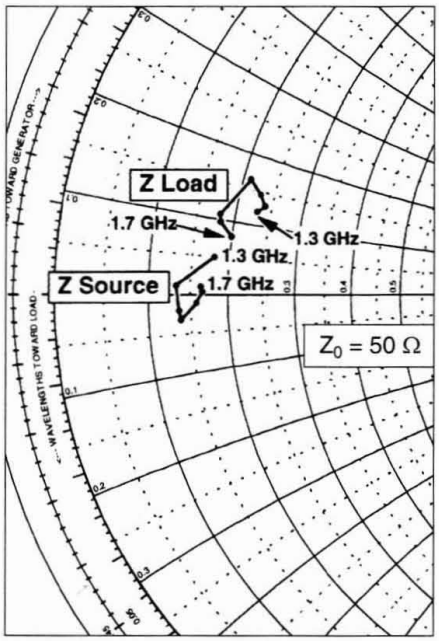
Impedance Data

(V_{DD} = 28 V, I_{DQ} = 75 mA, P_{OUT} = 6 W)





Frequency	Z Source Ω		Z Load Ω	
GHz	R	jX	R	jX
1.3	9.0	2.5	11.5	6.0
1.4	6.6	0.6	12.0	6.5
1.5	6.8	-1.0	11.5	7.3
1.5	6.9	-1.6	10.5	8.2
1.5	7.9	-0.6	9.0	5.4
1.6	8.3	0.2	9.1	4.9
1.7	8.2	0.5	10.0	4.0

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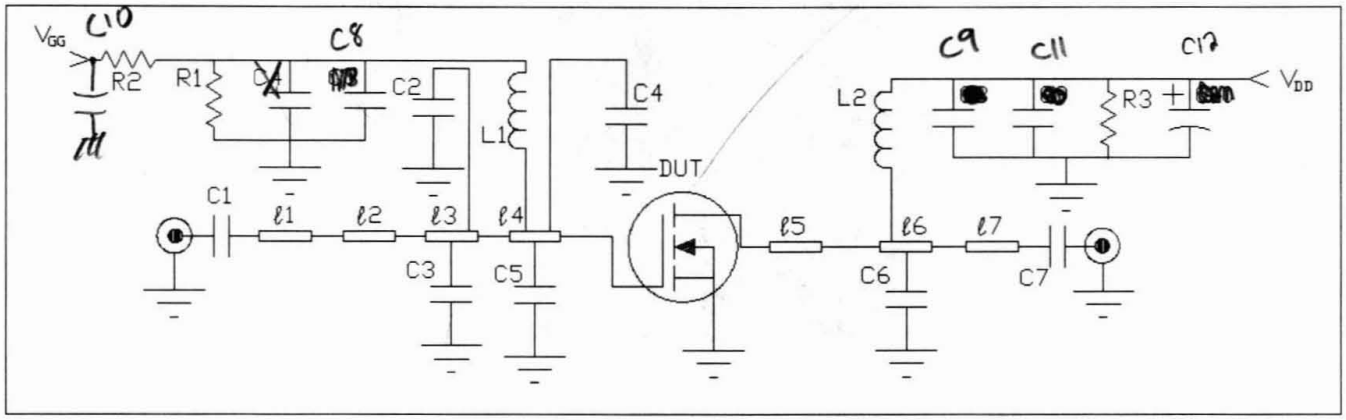
Typical Scattering Parameters

(V_{DS} = 28 V, I_D = 300 mA)

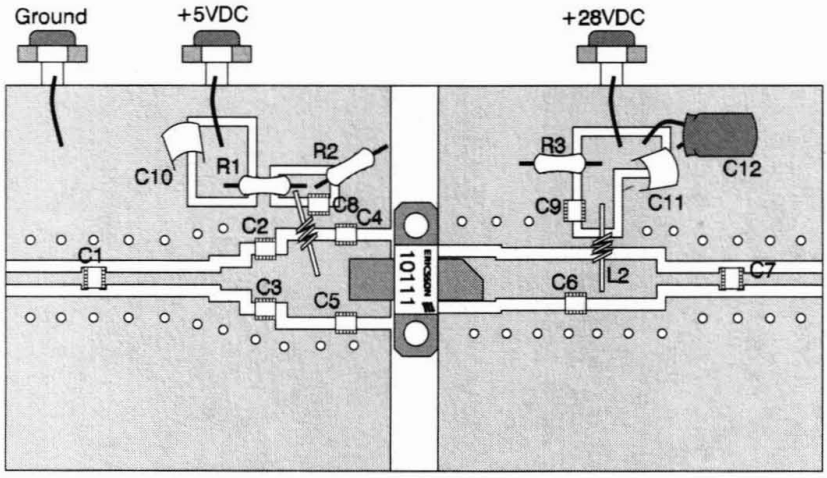
f	S11		S21		S12		S22	
(MHz)	Mag	Ang	Mag	Ang	Mag	Ang	Mag	Ang
100	0.867	-65	21.8	131	0.010	42	0.801	-41
200	0.832	-77	19.2	123	0.011	34	0.765	-50
300	0.843	-106	14.4	97	0.013	18	0.740	-72
400	0.844	-123	11.0	81	0.014	4	0.744	-88
500	0.852	-133	8.71	69	0.013	-7	0.774	-98
600	0.862	-140	7.08	59	0.011	-15	0.815	-107
700	0.868	-146	5.79	50	0.009	-19	0.836	-116
800	0.874	-151	4.80	42	0.007	-19	0.851	-123
900	0.882	-155	4.05	35	0.006	-16	0.861	-129
1000	0.886	-158	3.48	29	0.004	-7	0.869	-133
1100	0.893	-161	3.04	24	0.003	20	0.885	-137
1200	0.899	-164	2.69	19	0.003	57	0.897	-141
1300	0.907	-167	2.43	14	0.005	74	0.912	-145
1400	0.905	-170	2.19	9	0.007	80	0.921	-148
1500	0.903	-173	2.00	4	0.008	83	0.928	-151
1600	0.898	-175	1.83	0	0.011	85	0.929	-154
1700	0.896	-177	1.71	-5	0.013	86	0.933	-157
1800	0.892	-179	1.60	-9	0.016	83	0.934	-159
1900	0.889	178	1.52	-13	0.020	78	0.937	-161
2000	0.885	176	1.45	-17	0.023	69	0.940	-163
2100	0.882	173	1.40	-21	0.023	59	0.944	-165
2200	0.880	171	1.37	-25	0.021	60	0.950	-168

Test Circuit

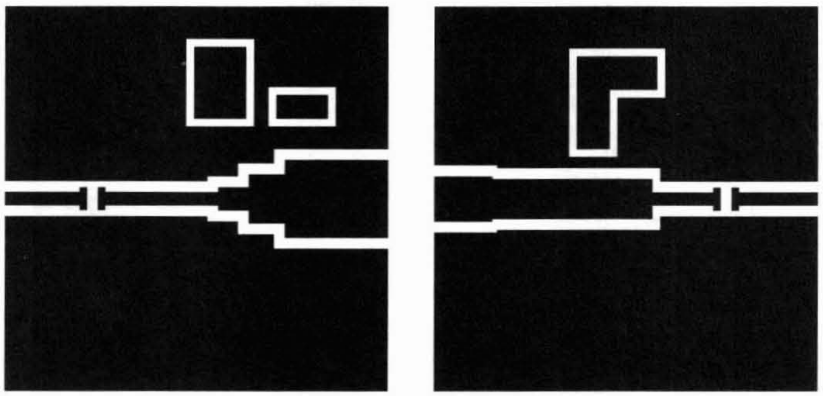


Test Circuit Block Diagram for f = 1.5 GHz

DUT	PTF 10111	
C1, C7–9	33 pF, Capacitor ATC 100 B	
C2, C3	2.2 pF, Capacitor ATC 200 B	
C10, C11	0.1 µF, 50 V, Capacitor	
C4, C5	1.5 pF, Capacitor ATC 100 A	
C6	2.0 pF, Capacitor ATC 100 A	
C12	100 µF, 50 V, Electrolytic Capacitor	
ℓ1	0.21 λ 1.5 GHz	Microstrip 50 Ω
ℓ2	0.037 λ 1.5 GHz	Microstrip 33.3 Ω
ℓ3	0.045 λ 1.5 GHz	Microstrip 18.5 Ω
ℓ4	0.13 λ 1.5 GHz	Microstrip 12.4 Ω
ℓ5	0.07 λ 1.5 GHz	Microstrip 19.8 Ω
ℓ6	0.20 λ 1.5 GHz	Microstrip 22 Ω
ℓ1	0.18 λ 1.5 GHz	Microstrip 50 Ω
L1, L2	3 Turn, #22 AWG, 0.120" I.D.	
R1, R2, R3	10 K, 1/4 W Resistor	
Circuit Board	.028" Dielectric Thickness, ε_r = 4.0, AlliedSignal, G200, 2 oz. copper	



Placement Diagram (not to scale)



Artwork (1 inch ———)

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L3
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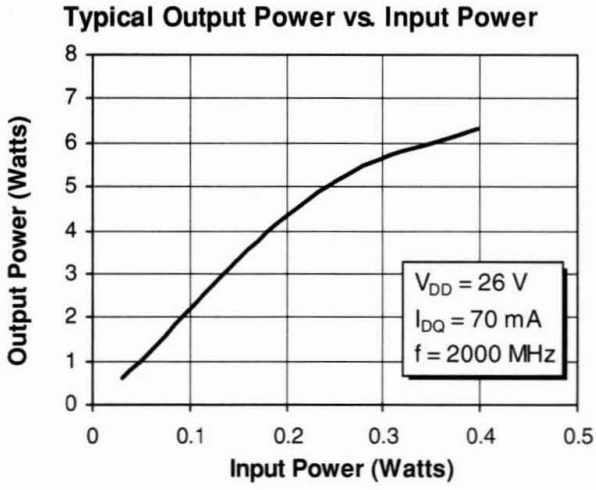
EUS/KR 1301-PTF 10111 Uen Rev. A 02-18-99

PTF 10135
5 Watts, 2.0 GHz
GOLDMOS™ Field Effect Transistor

Description

The PTF 10135 is a common source N-channel enhancement-mode lateral MOSFET intended for large signal applications from 1.0 to 2.0 GHz. It is rated at 5 watts minimum output power. Nitride surface passivation and gold metallization ensure excellent device lifetime and reliability. 100% lot traceability is standard.

- **Guaranteed Performance at 1.99 GHz, 26 V**
  - **Output Power = 5 Watts Min**
  - **Power Gain = 11 dB Min**
- **Gold Metallization**
- **Silicon Nitride Passivated**
- **Back Side Common Source**
- **Excellent Thermal Stability**



Package 20249

Maximum Ratings

Parameter	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	65	Vdc
Gate-Source Voltage	V_{GS}	±20	Vdc
Operating Junction Temperature	T_J	200	°C
Total Device Dissipation at T_{flange} = 25°C Above 25°C derate by	P_D	39 0.22	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{flange} = 70°C)	$R_{\theta JC}$	4.5	°C/W

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Electrical Characteristics (100% Tested)

Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 5 mA	$V_{(BR)DSS}$	65	—	—	Volts
Zero Gate Voltage Drain Current	V_{DS} = 26 V, V_{GS} = 0 V	I_{DSS}	—	—	1.0	mA
Gate Threshold Voltage	V_{DS} = 10 V, I_D = 75 mA	$V_{GS(th)}$	3.0	—	5.0	Volts
Forward Transconductance	V_{DS} = 10 V, I_D = 2 A	g_{fs}	—	0.8	—	Siemens

RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{DD} = 26 V, P_{OUT} = 1 W, I_{DQ} = 70 mA, f = 1.93, 1.99 GHz)	G_{ps}	11	—	—	dB
Power Output at 1 dB Compression (V_{DD} = 26 V, I_{DQ} = 70 mA, f = 1.99 GHz)	P-1dB	5	—	—	Watts
Drain Efficiency (V_{DD} = 26 V, P_{OUT} = 5 W, I_{DQ} = 70 mA, f = 1.99 GHz)	η_D	40	—	—	%
Load Mismatch Tolerance (V_{DD} = 26 V, P_{OUT} = 5 W, I_{DQ} = 70 mA, f = 1.99 GHz —all phase angles at frequency of test)	Ψ	—	—	10:1	—

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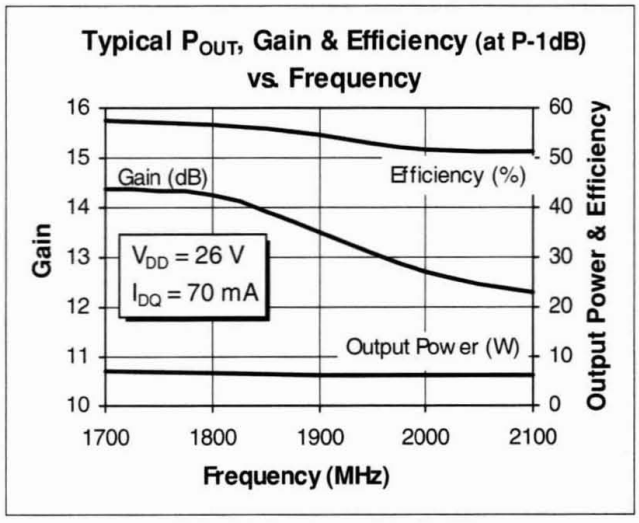
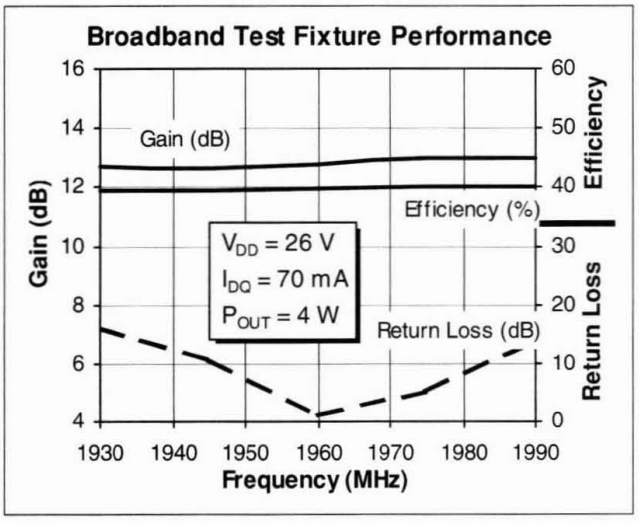
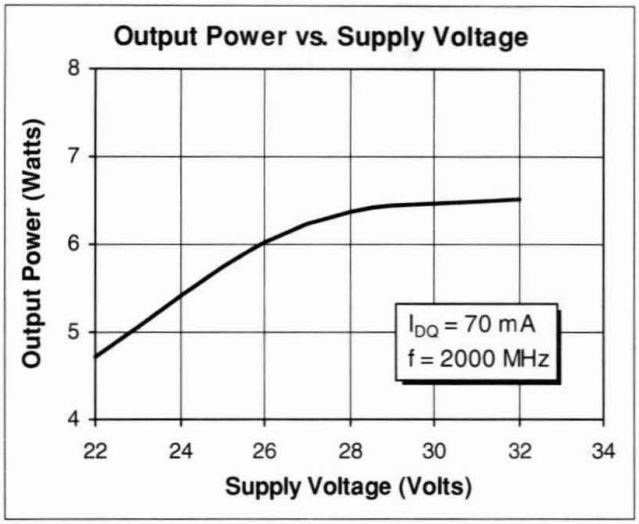
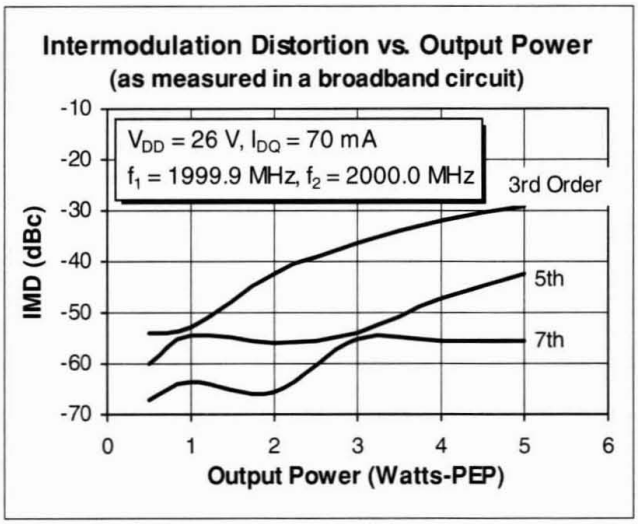
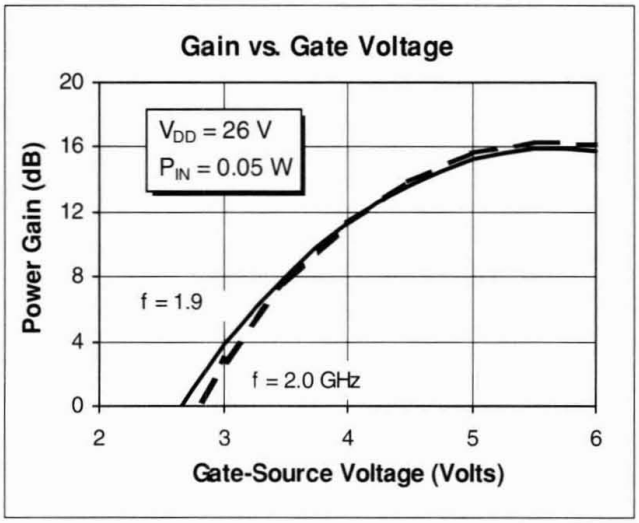
Typical Performance

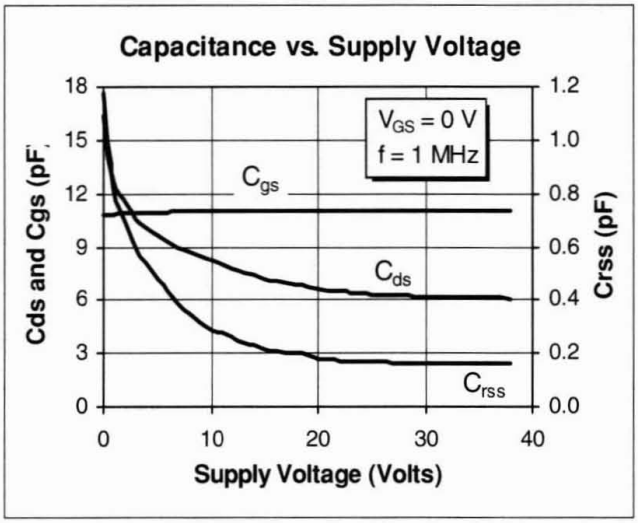


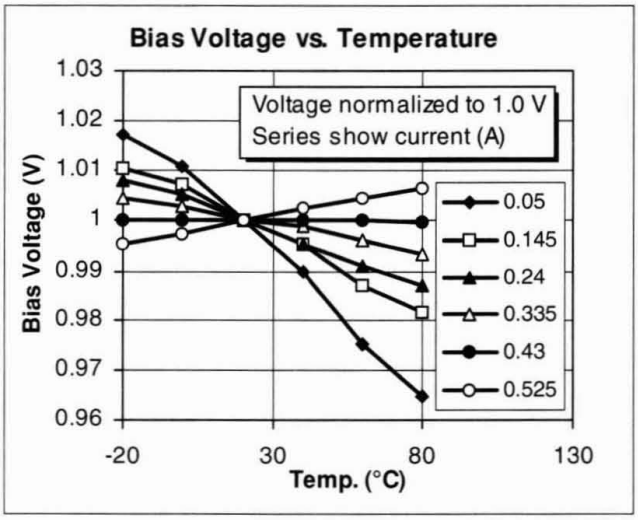



Output Power vs. Supply Voltage
Output Power (Watts)
Supply Voltage (Volts)
I_{DQ} = 70 mA
f = 2000 MHz


Intermodulation Distortion vs. Output Power
(as measured in a broadband circuit)
IMD (dBc)
Output Power (Watts-PEP)
V_{DD} = 26 V, I_{DQ} = 70 mA
f_1 = 1999.9 MHz, f_2 = 2000.0 MHz
3rd Order
5th
7th

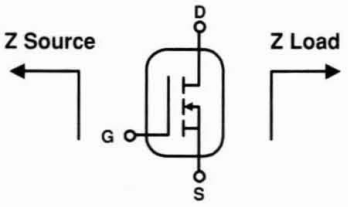

Gain vs. Gate Voltage
Power Gain (dB)
Gate-Source Voltage (Volts)
V_{DD} = 26 V
P_{IN} = 0.05 W
f = 1.9
f = 2.0 GHz


Capacitance vs. Supply Voltage
Cds and Cgs (pF)
Crss (pF)
Supply Voltage (Volts)
V_{GS} = 0 V
f = 1 MHz
C_{gs}
C_{ds}
C_{rss}

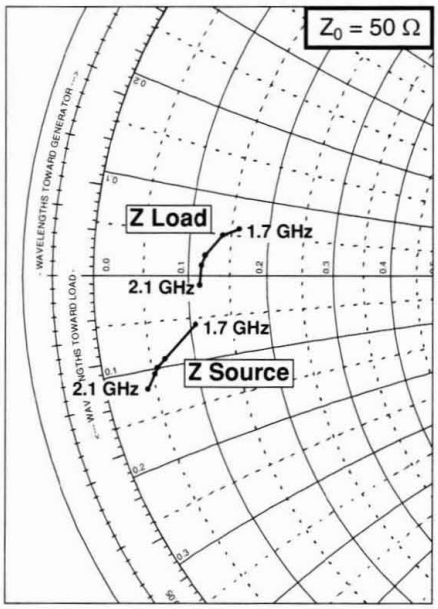

Bias Voltage vs. Temperature
Bias Voltage (V)
Temp. (°C)
Voltage normalized to 1.0 V
Series show current (A)
0.05
0.145
0.24
0.335
0.43
0.525

Impedance Data

V_{DD} = 26 V, P_{OUT} = 5 W, I_{DQ} = 70 mA



Frequency	Z Source Ω		Z Load Ω	
GHz	R	jX	R	jX
1.7	5.3	-2.9	8.0	3.0
1.8	3.3	-4.6	7.0	2.5
1.9	2.8	-5.0	6.0	1.2
2.0	2.6	-5.3	5.8	0.6
2.1	2.1	-6.0	5.7	-0.6



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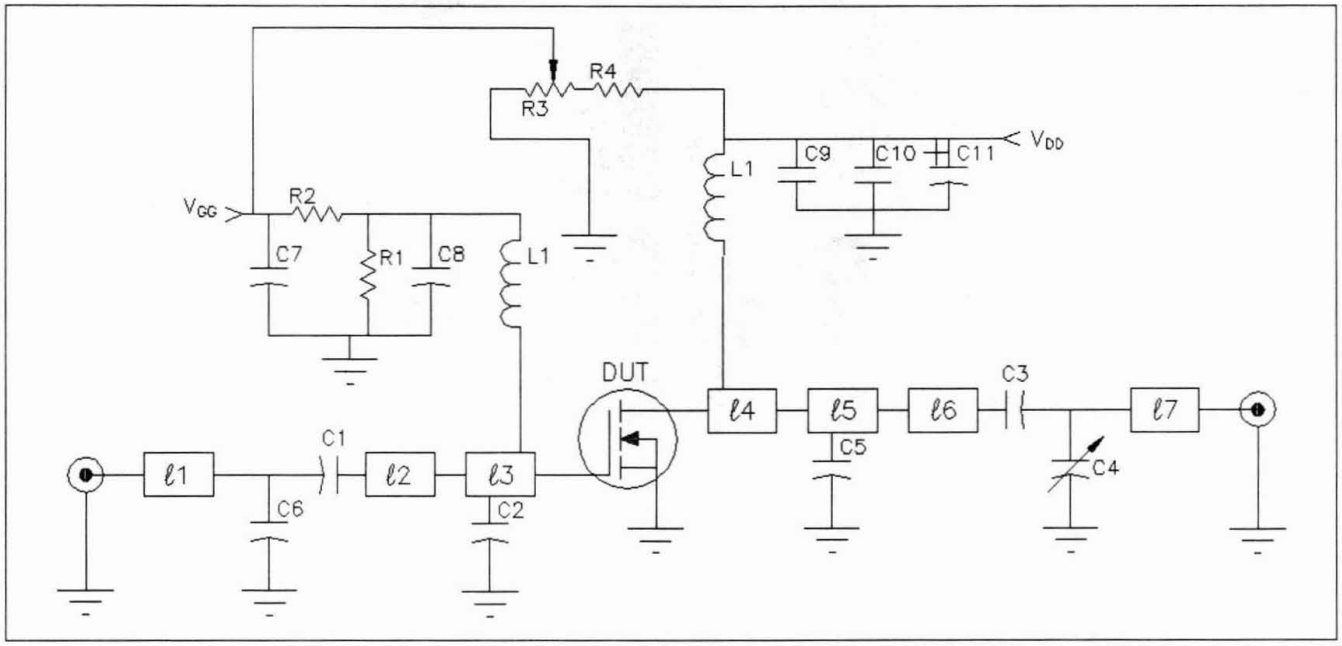
Typical Scattering Parameters

(V_{DS} = 26 V, I_{DQ} = 300 mA)

f	S11		S21		S12		S22	
(MHz)	Mag	Ang	Mag	Ang	Mag	Ang	Mag	Ang
100	0.874	-58	24.1	137	0.009	46	0.770	-35
400	0.889	-115.5	12.707	89.0	0.016	9.1	0.759	-73.3
500	0.892	-128.2	10.388	76.6	0.015	1.1	0.768	-83.2
600	0.897	-138.1	8.626	66.5	0.013	-5.3	0.798	-92.6
700	0.903	-148.6	7.283	54.4	0.011	-11.1	0.833	-103.7
800	0.860	-154.5	5.853	46.3	0.008	-14.7	0.825	-112.5
900	0.873	-159.3	4.977	39.6	0.006	2.4	0.837	-119.4
1000	0.873	-162.8	4.262	33.4	0.005	10.7	0.853	-126.7
1100	0.891	-166.9	3.736	27.5	0.004	42.5	0.861	-132.7
1200	0.890	-169.6	3.264	22.7	0.005	70.3	0.863	-137.9
1300	0.904	-173.1	2.911	17.1	0.007	82.9	0.875	-143.1
1400	0.896	-174.7	2.583	13.5	0.010	87.4	0.866	-146.7
1500	0.932	-177.4	2.395	8.3	0.013	87.3	0.896	-150.4
1600	0.932	179.2	2.155	3.6	0.015	88.4	0.905	-155.0
1700	0.950	175.8	1.988	-1.6	0.018	87.5	0.930	-158.7
1800	0.955	171.8	1.808	-6.4	0.021	84.4	0.944	-162.9
1900	0.959	167.4	1.656	-12.0	0.023	81.5	0.972	-167.9
2000	0.945	164.0	1.487	-16.2	0.026	78.8	0.955	-172.4
2100	0.946	160.4	1.354	-21.3	0.027	76.6	0.963	-176.8
2200	0.949	159.3	1.250	-24.5	0.030	72.6	0.948	-180.0
2300	0.953	156.3	1.152	-29.2	0.032	69.4	0.961	175.9
2400	0.946	155.4	1.050	-31.0	0.034	68.6	0.931	173.8

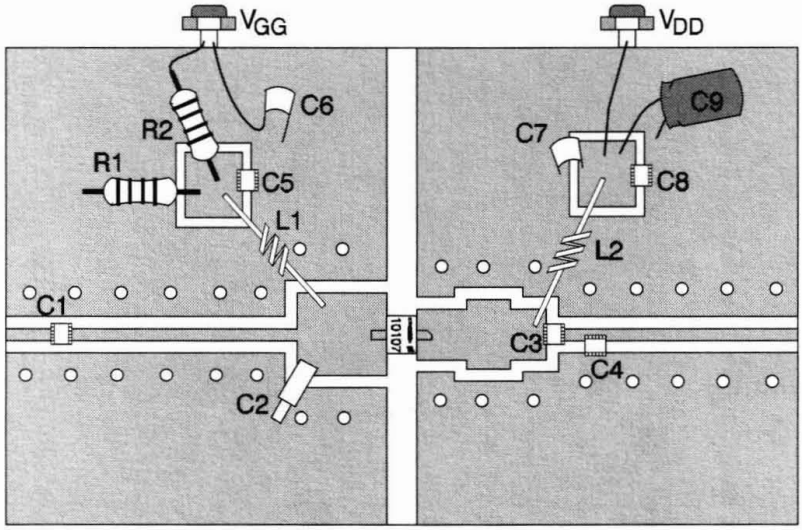
Test Circuit



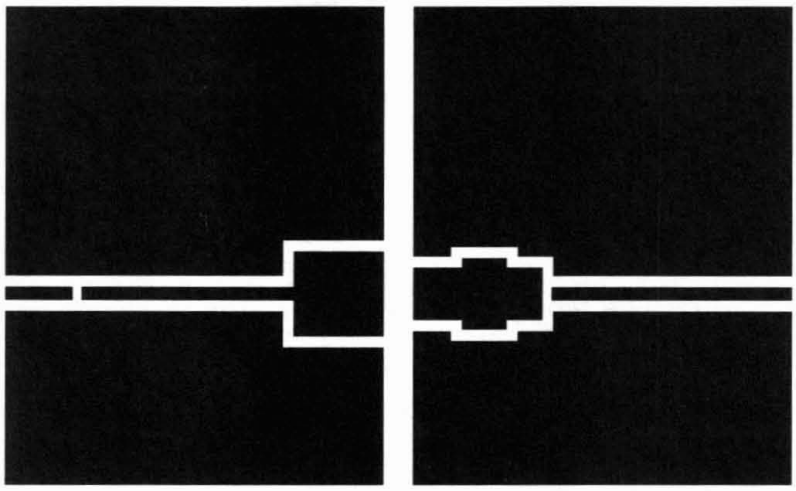
Block Diagram for f = 1.96 GHz

Q1	PTF 10135	LDMOS RF FET
ℓ1, ℓ2, ℓ7		Microstrip 50 Ω
ℓ3	0.149 λ 1.96 GHz	Microstrip 10.4 Ω
ℓ4	0.081 λ 1.96 GHz	Microstrip 15.9 Ω
ℓ5	0.073 λ 1.96 GHz	Microstrip 12.1 Ω
ℓ6	0.06 λ 1.96 GHz	Microstrip 15.9 Ω
C1, C3, C8, C9	33 pF	Chip Cap
C2, C5	0.7 pF	Chip Cap

C4	0.3–3.5 pF	Variable Capacitor
C6	0.3 pF	Chip Cap
C7, C10	0.1 µF	Chip Cap
C11	10 µF	SMT Tantalum
L1, L2	4 Turn	#20 AWG, .120" I.D.
R1, R2	220 Ω	Chip Resistor K1206
R3	2K	SMT Potentiometer
R4	10 Ω	Chip Resistor K1206
Circuit Board	.028" Dielectric Thickness, ε_r = 4.0, AlliedSignal, G200, 2 oz. copper	



Parts Layout (not to scale)



Artwork (1 inch ———)

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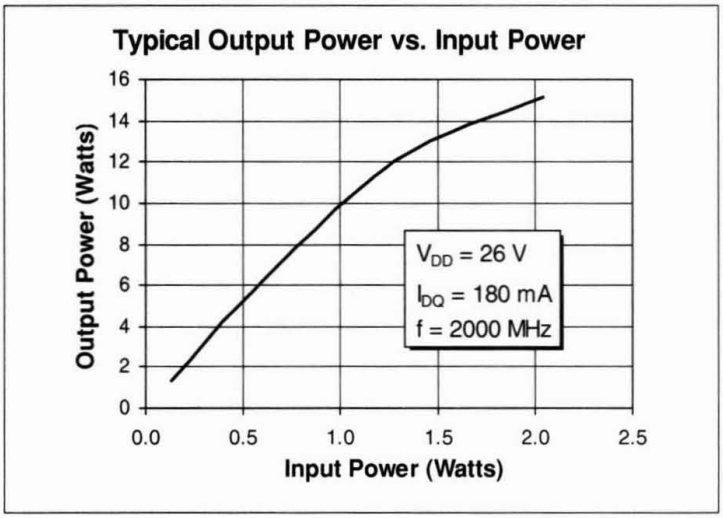
PTF 10041
12 Watts, 2.0 GHz
GOLDMOS™ Field Effect Transistor

Description

The PTF 10041 is a common source N-channel enhancement-mode lateral MOSFET intended for large signal applications from 1.0 to 2.0 GHz. It is rated at 12 watts power output. Nitride surface passivation and gold metallization ensure excellent device lifetime and reliability.

- Guaranteed Performance at 2.0 GHz, 26 V_{DS}
  - Output Power = 12 Watts Min
  - Power Gain = 10 dB Min
- Full Gold Metallization
- Silicon Nitride Passivated
- Excellent Thermal Stability
- Back Side Common Source
- 100% Lot Traceability



Package 20249

Maximum Ratings

Parameter	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	65	Vdc
Gate-Source Voltage	V_{GS}	±20	Vdc
Operating Junction Temperature	T_J	200	°C
Total Device Dissipation at T_{flange} = 25°C Above 25°C derate by	P_D	58 0.33	Watts W/°C
Storage Temperature	T_{STG}	150	°C
Thermal Resistance (T_{flange} = 70°C)	$R_{\theta JC}$	3.0	°C/W

PTF 10041

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Electrical Characteristics (100% Tested)

Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 5 mA	$V_{(BR)DSS}$	65	—	—	Volts
Zero Gate Voltage Drain Current	V_{DS} = 26 V, V_{GS} = 0 V	I_{DSS}	—	—	1.0	mA
Gate Threshold Voltage	V_{DS} = 10 V, I_D = 75 mA	$V_{GS(th)}$	3.0	—	5.0	Volts
Forward Transconductance	V_{DS} = 10 V, I_D = 2 A	g_{fs}	—	0.8	—	Siemens

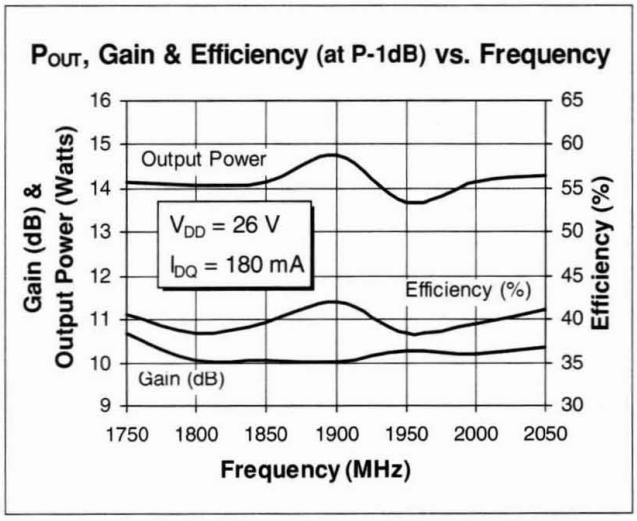
RF Specifications (100% Tested)

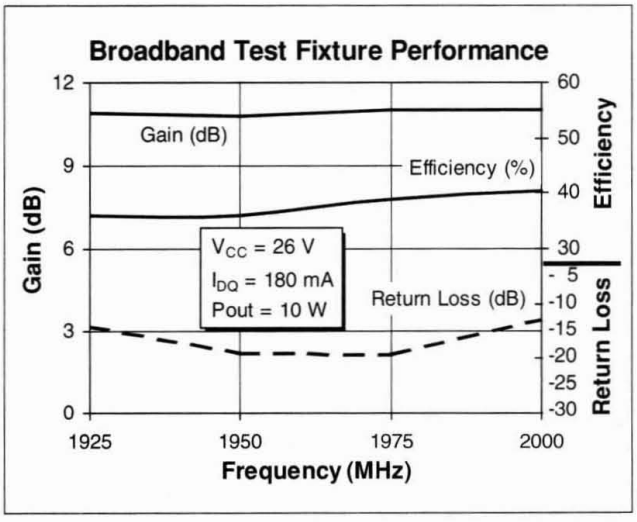
Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{DD} = 26 V, P_{OUT} = 3 W, I_{DQ} = 180 mA, f = 1.93, 2.0 GHz)	G_{ps}	10	—	—	dB
Power Output at 1 dB Compression (V_{DD} = 26 V, I_{DQ} = 180 mA, f = 2.0 GHz)	P-1dB	12	—	—	Watts
Drain Efficiency (V_{DD} = 26 V, P_{OUT} = 12 W, I_{DQ} = 180 mA, f = 2.0 GHz)	η	40	—	—	%
Load Mismatch Tolerance (V_{DD} = 26 V, P_{OUT} = 12 W, I_{DQ} = 180 mA, f = 2.0 GHz —all phase angles at frequency of test)	Ψ	—	—	10:1	—

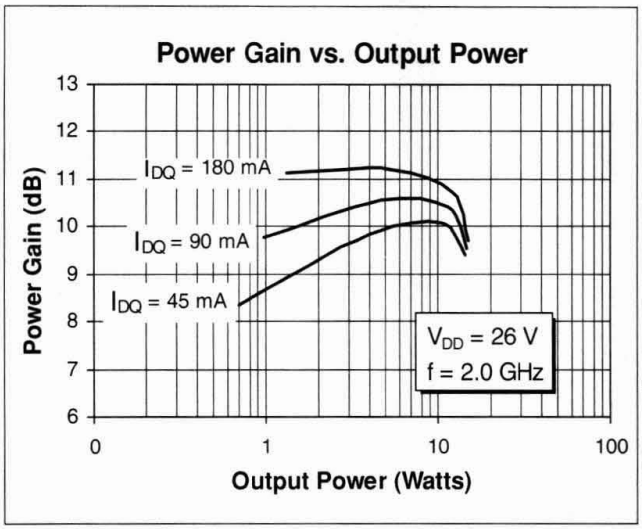
GOLDMOS™

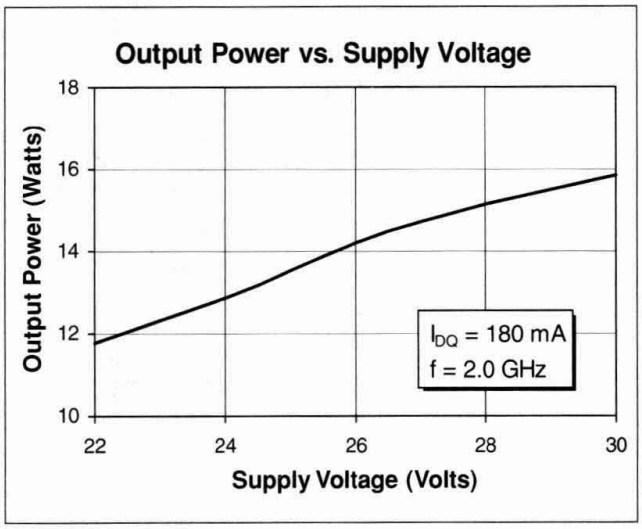
3

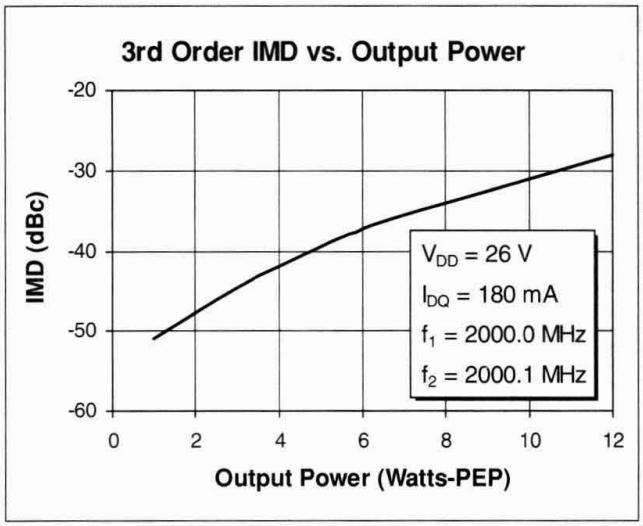
Typical Performance

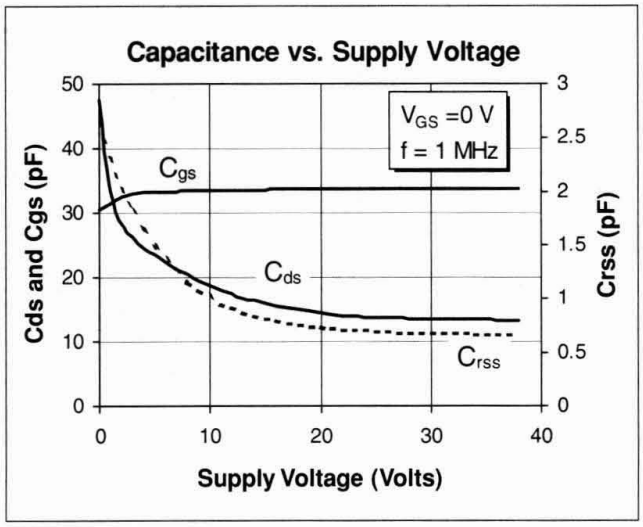


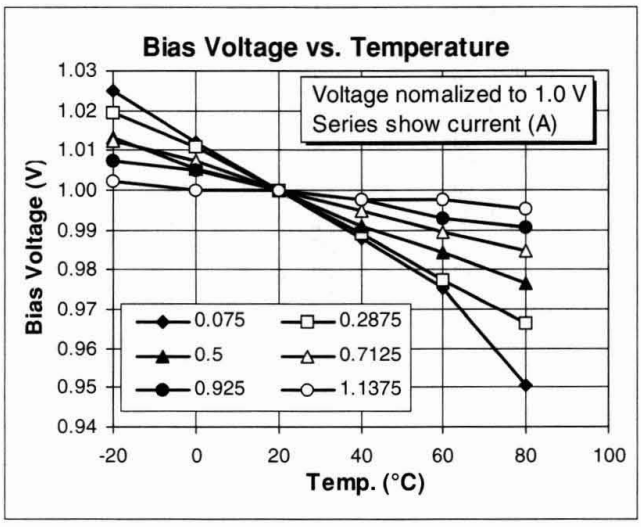



Power Gain vs. Output Power
Power Gain (dB)
Output Power (Watts)
I_{DQ} = 180 mA
I_{DQ} = 90 mA
I_{DQ} = 45 mA
V_{DD} = 26 V
f = 2.0 GHz


Output Power vs. Supply Voltage
Output Power (Watts)
Supply Voltage (Volts)
I_{DQ} = 180 mA
f = 2.0 GHz

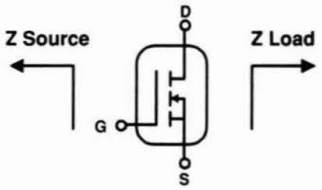

3rd Order IMD vs. Output Power
IMD (dBc)
Output Power (Watts-PEP)
V_{DD} = 26 V
I_{DQ} = 180 mA
f_1 = 2000.0 MHz
f_2 = 2000.1 MHz


Capacitance vs. Supply Voltage
Cds and Cgs (pF)
Crss (pF)
Supply Voltage (Volts)
V_{GS} =0 V
f = 1 MHz
C_{gs}
C_{ds}
C_{rss}

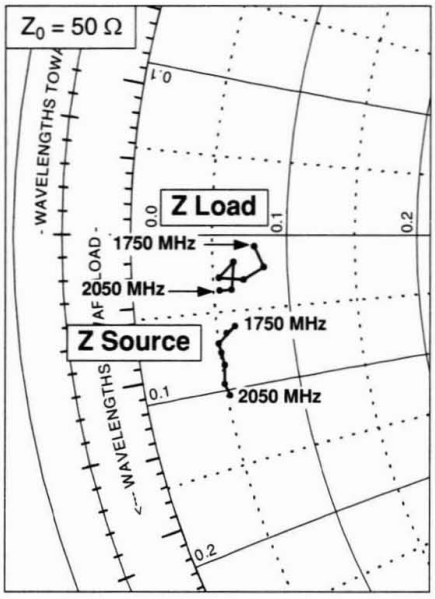

Bias Voltage vs. Temperature
Bias Voltage (V)
Temp. (°C)
Voltage nomalized to 1.0 V
Series show current (A)
0.075
0.2875
0.5
0.7125
0.925
1.1375

Impedance Data

V_{DD} = 26 V, P_{OUT} = 12 W, I_{DQ} = 180 mA



Frequency	Z Source Ω		Z Load Ω	
GHz	R	jX	R	jX
1.75	2.80	-3.2	3.9	-0.4
1.80	3.10	-3.0	4.2	-1.1
1.85	2.50	-3.5	3.5	-1.5
1.90	2.55	-3.8	2.7	-1.4
1.95	2.60	-4.2	3.2	-0.9
2.00	2.50	-4.8	3.1	-1.8
2.05	2.60	-5.2	2.7	-1.8



Typical Scattering Parameters

(V_{DS} = 26 V, I_D = 500 mA)

f	S11		S21		S12		S22	
(MHz)	Mag	Ang	Mag	Ang	Mag	Ang	Mag	Ang
100	0.820	-115	27.4	105	0.012	14	0.584	-80
200	0.814	-126	22.3	98	0.012	6	0.583	-90
300	0.865	-147	12.9	71	0.012	-11	0.653	-112
400	0.892	-156	8.73	57	0.010	-20	0.730	-124
500	0.913	-161	6.34	46	0.008	-26	0.791	-132
600	0.927	-165	4.79	37	0.007	-29	0.851	-139
700	0.938	-168	3.70	29	0.005	-25	0.887	-146
800	0.945	-171	2.92	23	0.003	-13	0.895	-152
900	0.954	-173	2.36	17	0.003	7	0.908	-156
1000	0.960	-175	1.94	12	0.003	36	0.914	-159
1100	0.970	-177	1.62	8	0.003	55	0.933	-161
1200	0.974	-179	1.38	3	0.004	67	0.944	-164
1300	0.977	180	1.18	-1	0.005	72	0.953	-166
1400	0.977	178	1.02	-5	0.006	75	0.959	-169
1500	0.977	177	0.894	-9	0.007	76	0.963	-171
1600	0.978	176	0.788	-13	0.008	78	0.964	-173
1700	0.983	174	0.702	-16	0.009	80	0.970	-174
1800	0.987	173	0.631	-20	0.010	79	0.973	-176
1900	0.991	172	0.571	-23	0.011	78	0.976	-178
2000	0.994	171	0.520	-27	0.012	77	0.978	-179
2100	0.992	169	0.477	-31	0.013	76	0.978	179
2200	0.991	168	0.440	-35	0.014	74	0.980	178

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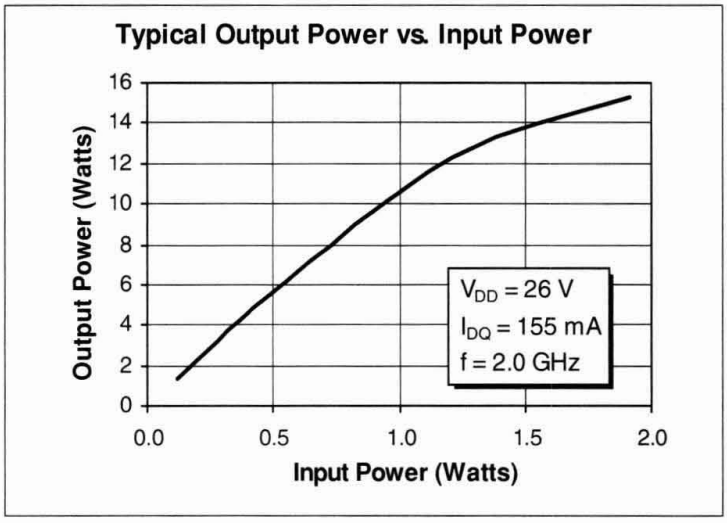
PTF 10053
12 Watts, 2.0 GHz
GOLDMOS™ Field Effect Transistor

Description

The PTF 10053 is a common source N-channel enhancement-mode lateral MOSFET intended for large signal applications from 1.0 to 2.0 GHz. It is rated at 12 watts power output. Nitride surface passivation and gold metallization ensure excellent device lifetime and reliability.

- Guaranteed Performance at 1.99 GHz, 26 V
  - Output Power = 12 Watts Min
  - Power Gain = 12 dB Typ
- Full Gold Metallization
- Silicon Nitride Passivated
- Back Side Common Source
- Excellent Thermal Stability
- 100% lot traceability



Package 20244

Maximum Ratings

Parameter	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	65	Vdc
Gate-Source Voltage	V_{GS}	±20	Vdc
Operating Junction Temperature	T_J	200	°C
Total Device Dissipation at T_{flange} = 25°C Above 25°C derate by	P_D	58 0.33	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{flange} = 70°C)	$R_{\theta JC}$	3.0	°C/W

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Electrical Characteristics (100% Tested)

Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 5 mA	$V_{(BR)DSS}$	65	—	—	Volts
Zero Gate Voltage Drain Current	V_{DS} = 26 V, V_{GS} = 0 V	I_{DSS}	—	—	1.0	mA
Gate Threshold Voltage	V_{DS} = 10 V, I_D = 75 mA	$V_{GS(th)}$	3.0	—	5.0	Volts
Forward Transconductance	V_{DS} = 10 V, I_D = 2 A	g_{fs}	—	0.8	—	Siemens

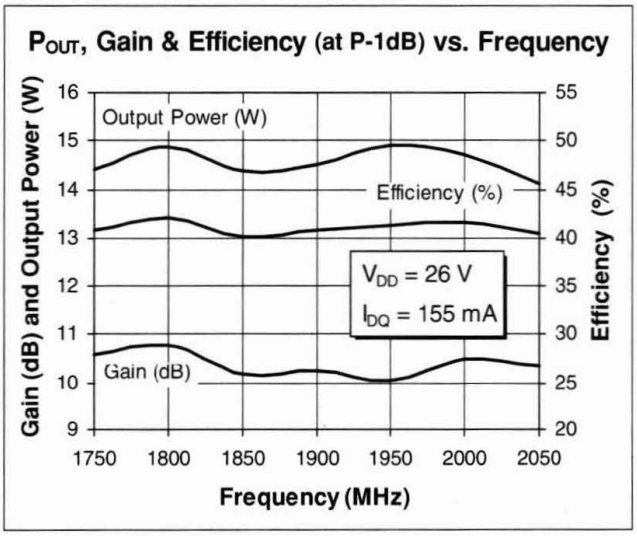
RF Specifications (100% Tested)

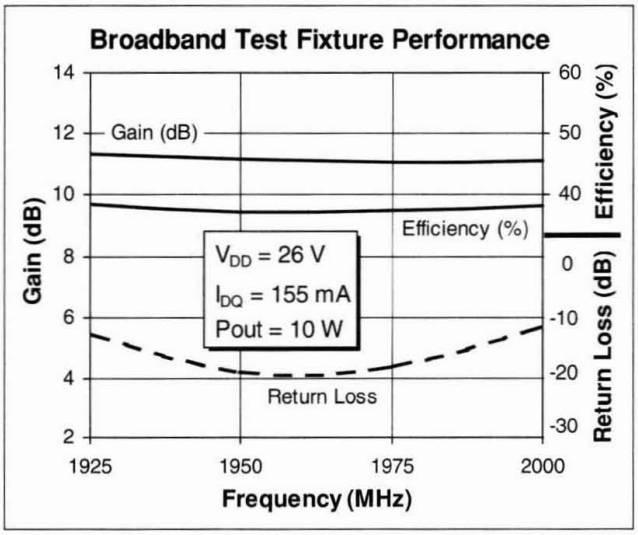
Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{DD} = 26 V, P_{out} = 3 W, I_{DQ} = 155 mA, f = 1.93, 1.99 GHz)	G_{ps}	10	12	—	dB
Power Output at 1 dB Compression (V_{DD} = 26 V, I_{DQ} = 155 mA, f = 1.99 GHz)	P-1dB	12	—	—	Watts
Drain Efficiency (V_{DD} = 26 V, P_{out} = 12 W, I_{DQ} = 155 mA, f = 1.99 GHz)	η_D	40	—	—	%
Load Mismatch Tolerance (V_{DD} = 26 V, P_{out} = 12 W, I_{DQ} = 155 mA, f = 1.99 GHz —all phase angles at frequency of test)	Ψ	—	—	10:1	—

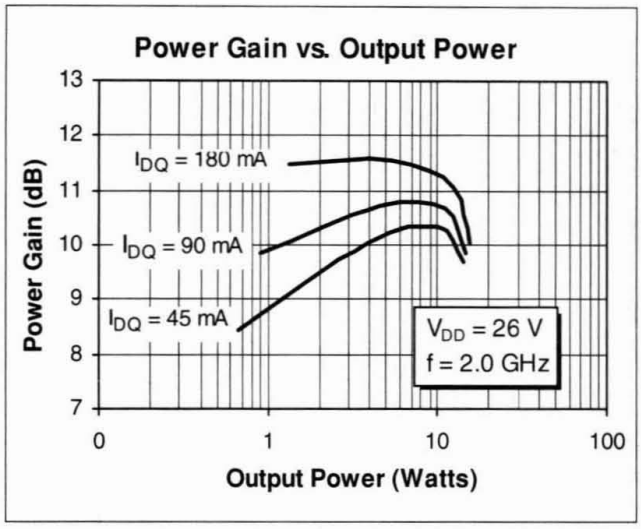
GOLDMOS™

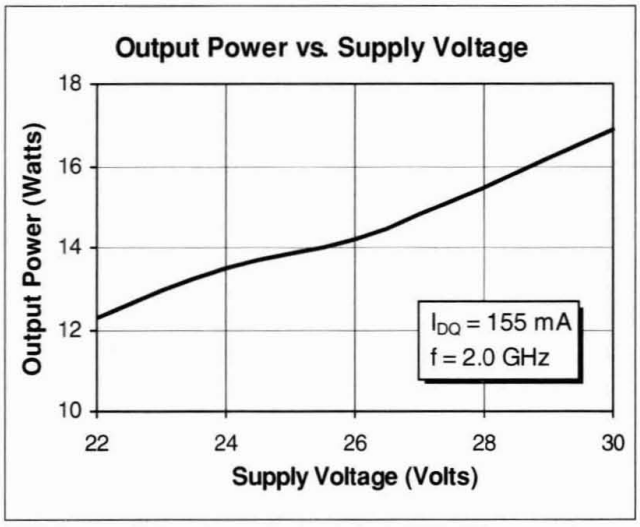
3

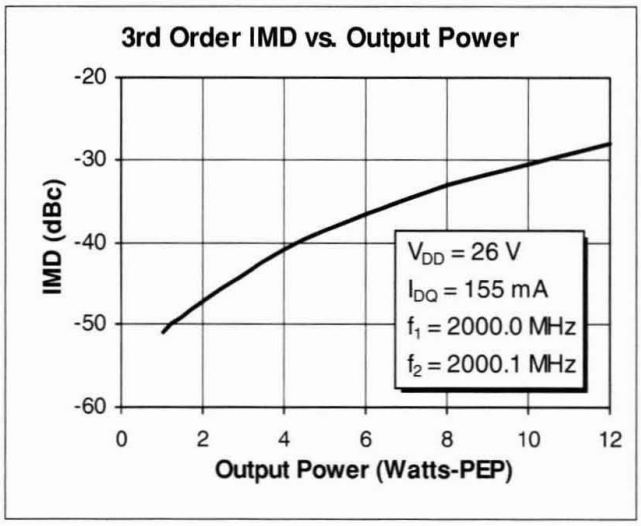
Typical Performance

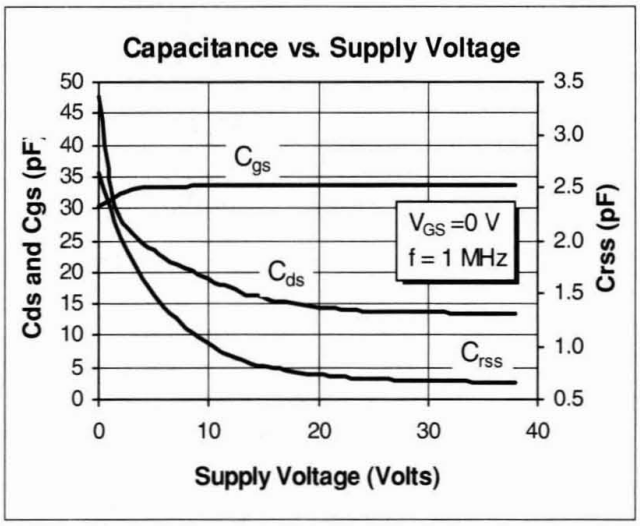


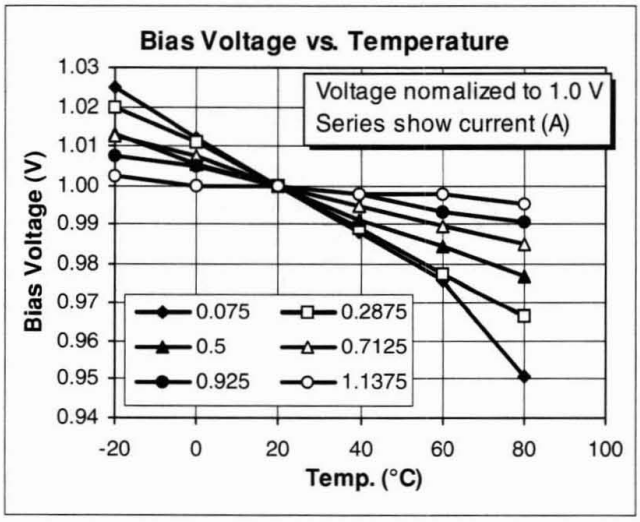



Power Gain vs. Output Power
Power Gain (dB)
Output Power (Watts)
I_{DQ} = 180 mA
I_{DQ} = 90 mA
I_{DQ} = 45 mA
V_{DD} = 26 V
f = 2.0 GHz
13
12
11
10
9
8
7
0
1
10
100


Output Power vs. Supply Voltage
Output Power (Watts)
Supply Voltage (Volts)
I_{DQ} = 155 mA
f = 2.0 GHz
18
16
14
12
10
22
24
26
28
30

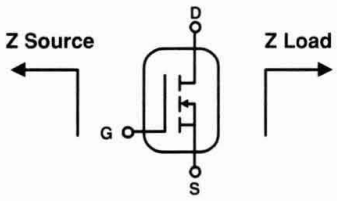

3rd Order IMD vs. Output Power
IMD (dBc)
Output Power (Watts-PEP)
V_{DD} = 26 V
I_{DQ} = 155 mA
f_1 = 2000.0 MHz
f_2 = 2000.1 MHz
-20
-30
-40
-50
-60
0
2
4
6
8
10
12

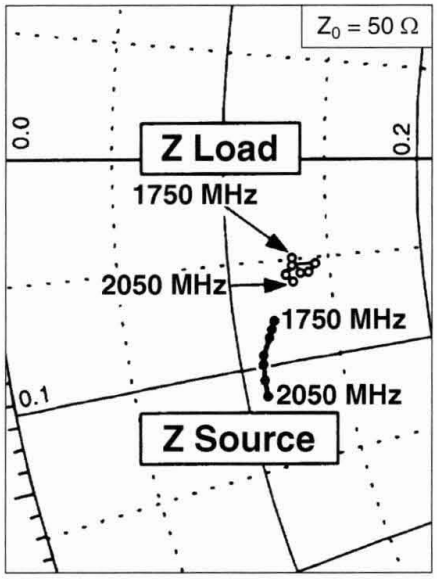

Capacitance vs. Supply Voltage
Cds and Cgs (pF)
Crss (pF)
Supply Voltage (Volts)
C_{gs}
C_{ds}
C_{rss}
V_{GS} =0 V
f = 1 MHz
50
45
40
35
30
25
20
15
10
5
0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0
10
20
30
40


Bias Voltage vs. Temperature
Bias Voltage (V)
Temp. (°C)
Voltage nomalized to 1.0 V
Series show current (A)
0.075
0.2875
0.5
0.7125
0.925
1.1375
1.03
1.02
1.01
1.00
0.99
0.98
0.97
0.96
0.95
0.94
-20
0
20
40
60
80
100

Impedance Data

V_{DD} = 26 V, P_{out} = 12 W, I_{DQ} = 155 mA





Frequency	Z Source Ω		Z Load Ω	
GHz	R	jX	R	jX
1.75	2.70	-4.0	3.3	-2.5
1.80	2.60	-4.2	3.5	-2.9
1.85	2.50	-4.4	3.7	-2.9
1.90	2.30	-4.8	3.9	-2.7
1.95	2.25	-5.0	3.3	-2.7
2.00	2.20	-5.4	3.1	-2.9
2.05	2.20	-5.8	3.3	-3.1

Typical Scattering Parameters

(V_{DS} = 26 V, I_D = 500 mA)

f	S11		S21		S12		S22	
(MHz)	Mag	Ang	Mag	Ang	Mag	Ang	Mag	Ang
100	0.806	-117	25.9	103	0.012	12	0.578	-80
200	0.800	-127	21.1	96	0.012	4	0.577	-90
300	0.850	-149	12.1	69	0.011	-15	0.650	-113
400	0.878	-158	8.19	54	0.010	-25	0.729	-125
500	0.900	-163	5.94	43	0.008	-31	0.791	-134
600	0.914	-168	4.49	33	0.006	-35	0.851	-142
700	0.925	-171	3.46	25	0.004	-31	0.888	-150
800	0.932	-174	2.73	18	0.003	-16	0.896	-156
900	0.941	-177	2.20	12	0.002	16	0.909	-160
1000	0.947	-180	1.81	6	0.003	52	0.915	-164
1100	0.957	178	1.52	1	0.004	66	0.933	-167
1200	0.961	176	1.29	-4	0.005	73	0.944	-170
1300	0.963	173	1.11	-9	0.006	74	0.953	-173
1400	0.963	171	0.957	-14	0.007	75	0.959	-176
1500	0.963	170	0.839	-19	0.008	75	0.963	-178
1600	0.964	168	0.741	-23	0.009	75	0.964	179
1700	0.968	166	0.664	-27	0.010	75	0.968	177
1800	0.972	165	0.600	-31	0.011	74	0.972	175
1900	0.976	163	0.546	-36	0.012	72	0.974	173
2000	0.978	161	0.499	-40	0.013	71	0.976	171
2100	0.976	159	0.460	-44	0.014	69	0.975	169
2200	0.975	157	0.427	-48	0.015	67	0.977	167

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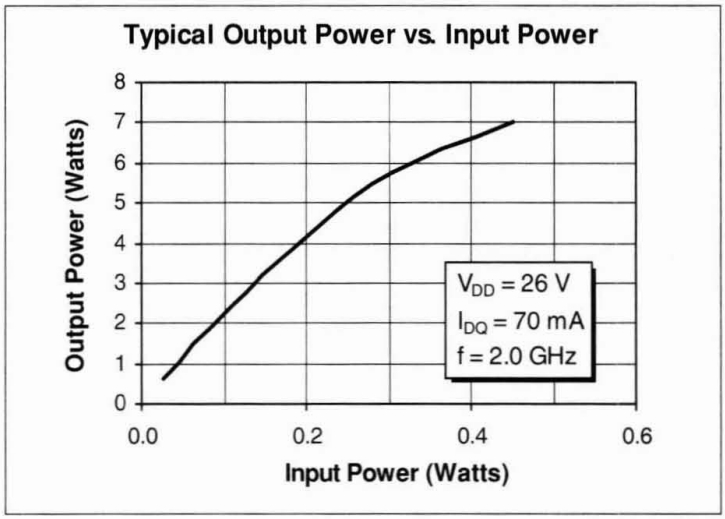
PTF 10107
5 Watts, 2.0 GHz
GOLDMOS™ Field Effect Transistor

Description

The 10107 is a common source N-channel enhancement-mode lateral MOSFET intended for large signal applications from 1.0 to 2.0 GHz. It is rated at 5 watts power output. Nitride surface passivation and gold metallization ensure excellent device lifetime and reliability.

- **Guaranteed Performance at 1.99 GHz, 26 V**
  - **Output Power = 5 Watts Min**
  - **Power Gain = 11 dB Min**
- **Full Gold Metallization**
- **Silicon Nitride Passivated**
- **Back Side Common Source**
- **Excellent Thermal Stability**
- **100% lot traceability**



Package 20244

Maximum Ratings

Parameter	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	65	Vdc
Gate-Source Voltage	V_{GS}	±20	Vdc
Operating Junction Temperature	T_J	200	°C
Total Device Dissipation at Above 25°C derate by	P_D	39 0.22	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{flange} = 70°C)	$R_{\theta JC}$	4.5	°C/W

ERICSSON

Electrical Characteristics (100% Tested)

Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 20 mA	$V_{(BR)DSS}$	65	—	—	Volts
Zero Gate Voltage Drain Current	V_{DS} = 26 V, V_{GS} = 0 V	I_{DSS}	—	—	1.0	mA
Gate Threshold Voltage	V_{DS} = 10 V, I_D = 75 mA	$V_{GS(th)}$	3.0	—	5.0	Volts
Forward Transconductance	V_{DS} = 10 V, I_D = 2 A	g_{fs}	—	0.8	—	Siemens

RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{DD} = 26 V, P_{OUT} = 1 W, I_{DQ} = 70 mA, f = 1.93, 1.99 GHz)	G_{ps}	11	—	—	dB
Power Output at 1 dB Compression (V_{DD} = 26 V, I_{DQ} = 70 mA, f = 1.99 GHz)	P-1dB	5	6.5	—	Watts
Drain Efficiency (V_{DD} = 26 V, P_{OUT} = 5 W, I_{DQ} = 70 mA, f = 1.99 GHz)	η_D	40	—	—	%
Load Mismatch Tolerance (V_{DD} = 26 V, P_{OUT} = 5 W, I_{DQ} = 70 mA, f = 1.99 GHz —all phase angles at frequency of test)	Ψ	—	—	10:1	—

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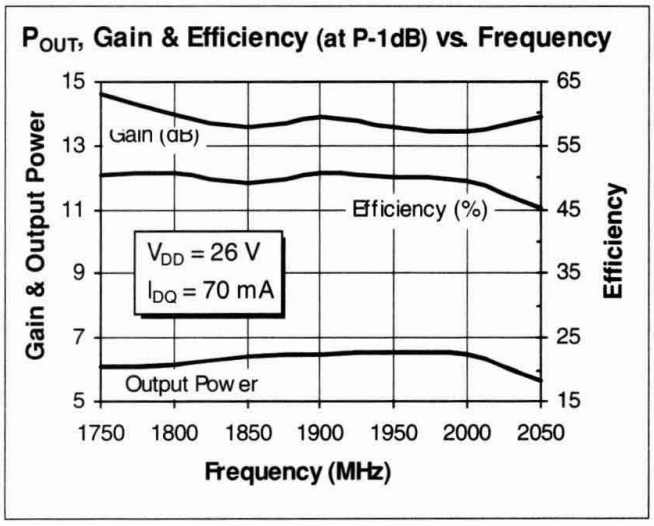
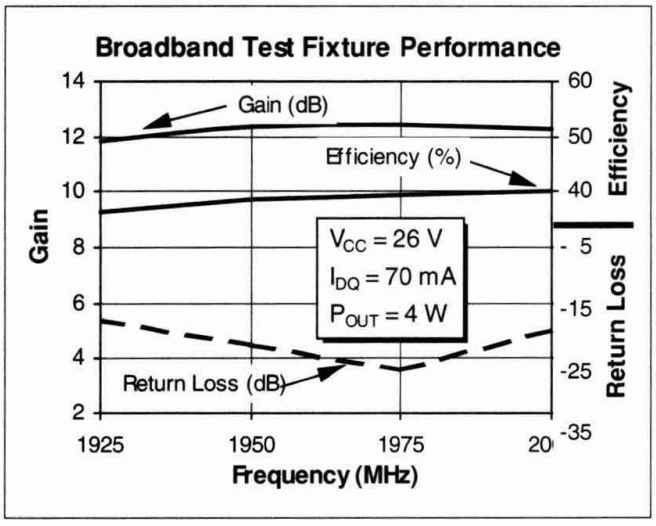
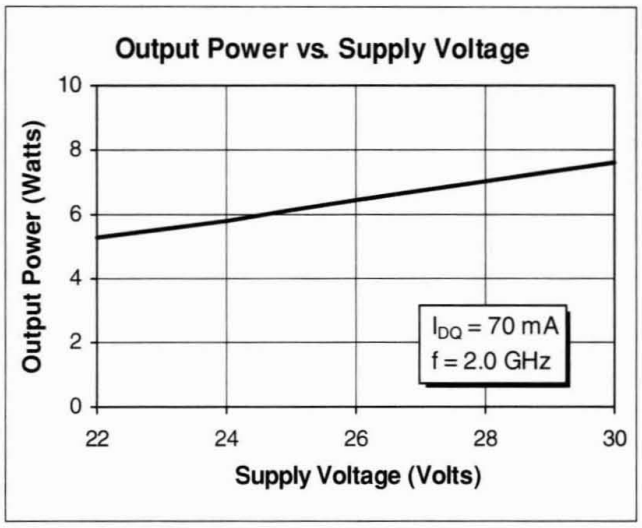
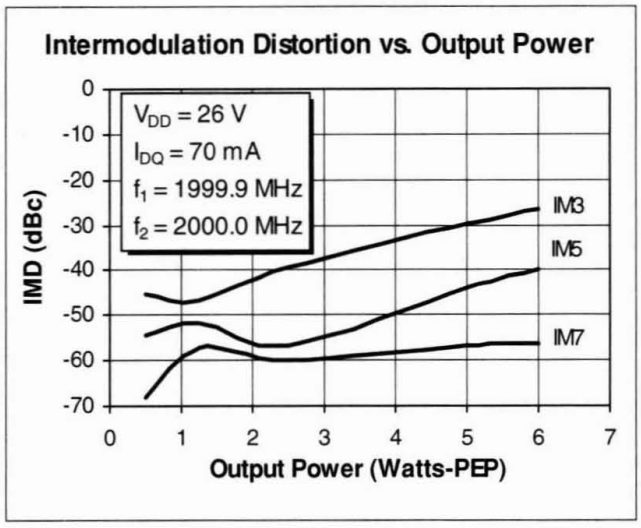
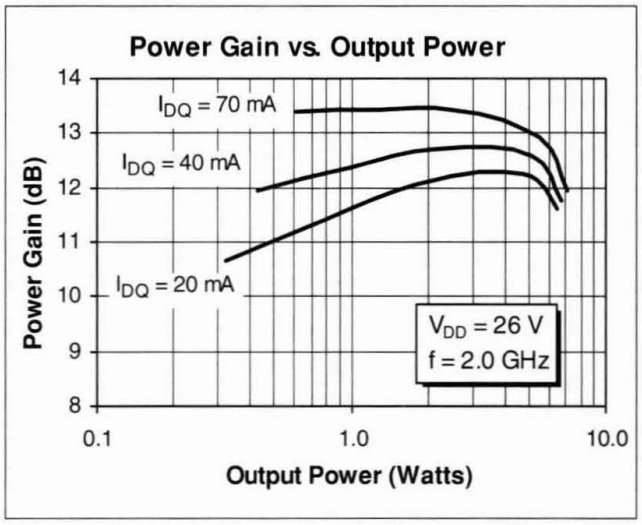
Typical Performance

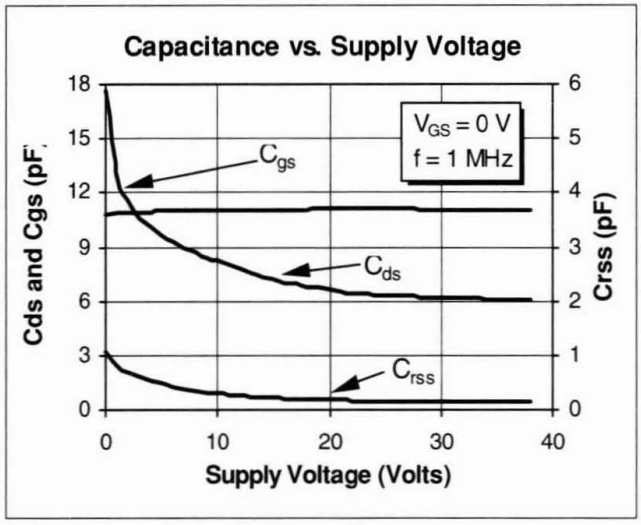


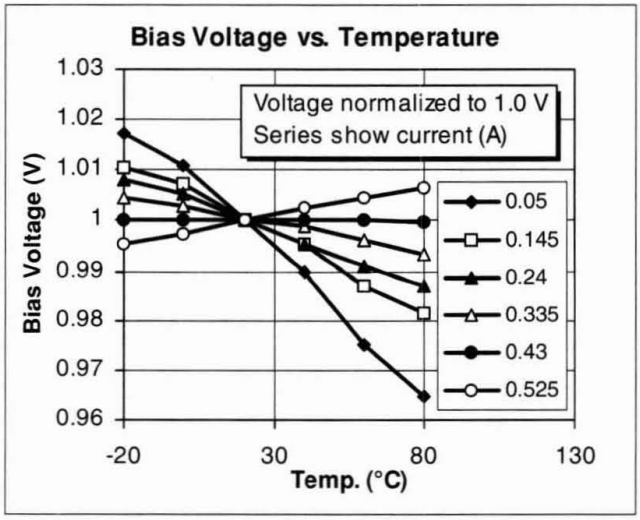



Output Power vs. Supply Voltage
Output Power (Watts)
Supply Voltage (Volts)
I_{DQ} = 70 mA
f = 2.0 GHz


Intermodulation Distortion vs. Output Power
IMD (dBc)
Output Power (Watts-PEP)
V_{DD} = 26 V
I_{DQ} = 70 mA
f_1 = 1999.9 MHz
f_2 = 2000.0 MHz
IM3
IM5
IM7

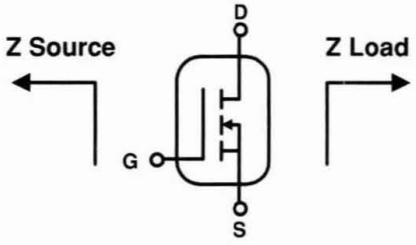

Power Gain vs. Output Power
Power Gain (dB)
Output Power (Watts)
I_{DQ} = 70 mA
I_{DQ} = 40 mA
I_{DQ} = 20 mA
V_{DD} = 26 V
f = 2.0 GHz

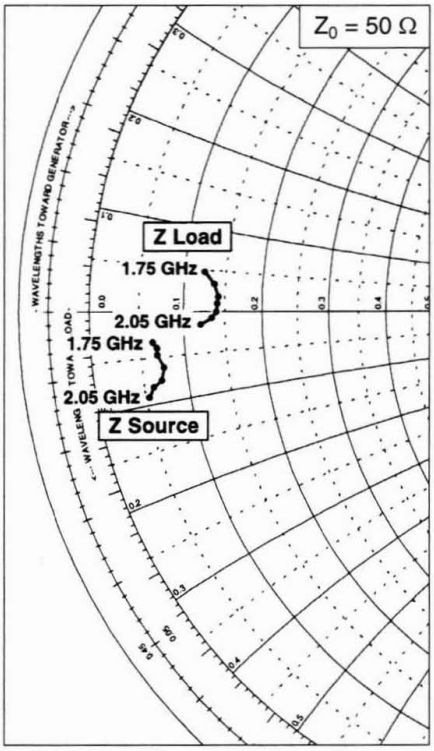

Capacitance vs. Supply Voltage
Cds and Cgs (pF)
Crss (pF)
Supply Voltage (Volts)
V_{GS} = 0 V
f = 1 MHz
C_{gs}
C_{ds}
C_{rss}


Bias Voltage vs. Temperature
Bias Voltage (V)
Temp. (°C)
Voltage normalized to 1.0 V
Series show current (A)
0.05
0.145
0.24
0.335
0.43
0.525

Impedance Data

V_{DD} = 26 V, P_{OUT} = 5 W, I_{DQ} = 70 mA





Frequency	Z Source Ω		Z Load Ω	
GHz	R	jX	R	jX
1.75	3.2	-1.7	6.20	2.4
1.80	3.4	-2.0	6.80	1.7
1.85	3.4	-2.4	7.10	0.9
1.90	3.7	-3.1	7.05	0.5
1.95	3.5	-3.8	7.00	0.0
2.00	3.0	-4.1	6.70	-0.4
2.05	2.7	-4.6	6.00	-0.8

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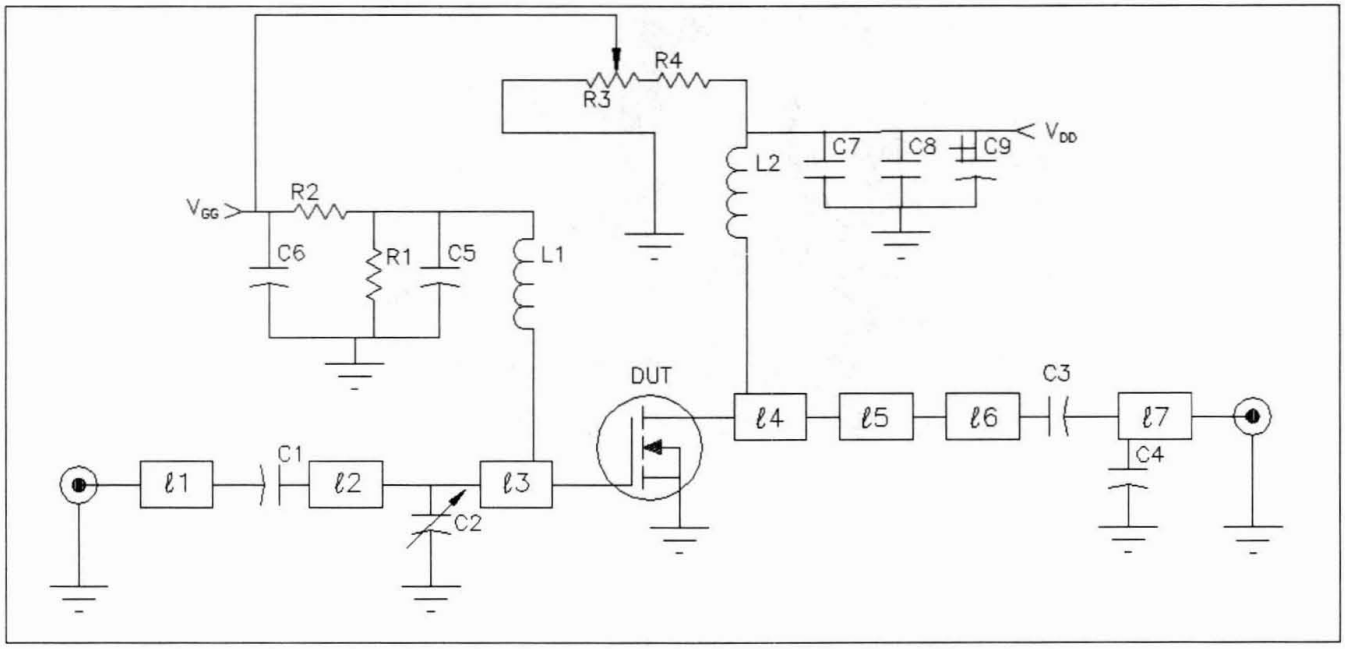
Typical Scattering Parameters

(V_{DS} = 26 V, I_D = 300 mA)

f	S11		S21		S12		S22	
(MHz)	Mag	Ang	Mag	Ang	Mag	Ang	Mag	Ang
100	0.874	-58	24.1	137	0.009	46	0.770	-35
200	0.837	-70	21.8	129	0.010	37	0.737	-42
300	0.844	-100	17.5	106	0.012	21	0.710	-62
400	0.850	-118	14.1	89	0.013	9	0.709	-77
500	0.858	-130	11.5	77	0.012	-1	0.723	-88
600	0.864	-139	9.44	66	0.011	-8	0.749	-98
700	0.868	-146	7.86	56	0.009	-13	0.767	-108
800	0.870	-153	6.61	48	0.008	-15	0.782	-116
900	0.879	-158	5.65	40	0.006	-13	0.801	-123
1000	0.887	-162	4.86	33	0.004	-2	0.815	-130
1100	0.898	-167	4.24	26	0.004	19	0.837	-136
1200	0.905	-171	3.73	20	0.004	48	0.854	-141
1300	0.911	-174	3.30	14	0.005	66	0.870	-147
1400	0.914	-178	2.92	8	0.006	74	0.882	-152
1500	0.916	179	2.61	2	0.008	77	0.892	-156
1600	0.918	176	2.35	-3	0.009	79	0.898	-160
1700	0.923	173	2.14	-8	0.011	79	0.907	-164
1800	0.928	171	1.95	-13	0.013	78	0.914	-168
1900	0.933	168	1.79	-18	0.015	76	0.920	-172
2000	0.937	165	1.65	-23	0.017	74	0.925	-176
2100	0.935	162	1.53	-28	0.018	71	0.929	-179
2200	0.934	159	1.43	-33	0.020	68	0.934	178

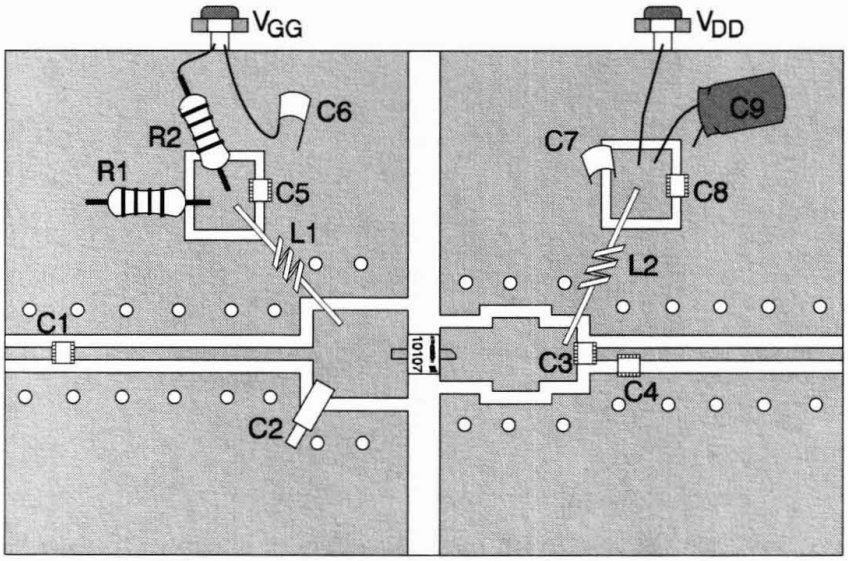
Test Circuit



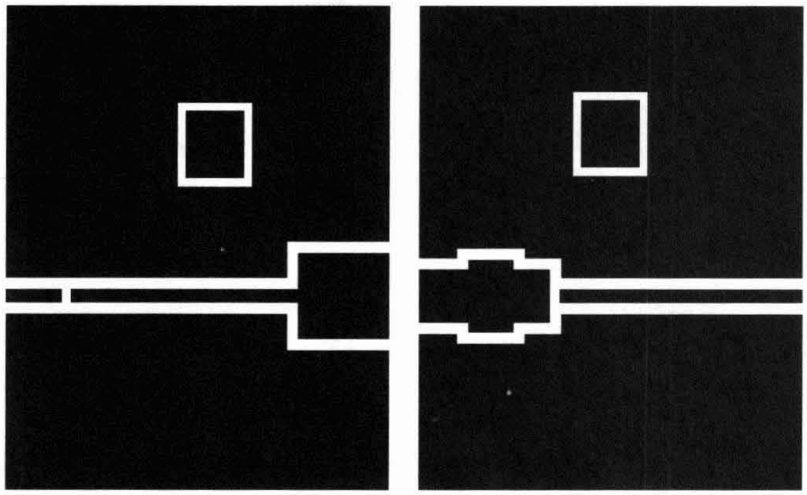
Block Diagram for f = 1.96 GHz

Q1	PTF 10107	LDMOS RF FET
ℓ1, ℓ2, ℓ7		Microstrip 50 Ω
ℓ3	0.149 λ 1.96 GHz	Microstrip 10.4 Ω
ℓ4	0.081 λ 1.96 GHz	Microstrip 15.9 Ω
ℓ5	0.073 λ 1.96 GHz	Microstrip 12.1 Ω
ℓ6	0.06 λ 1.96 GHz	Microstrip 15.9 Ω
C1, C3, C5, C8	33 pF	Chip Cap
C2	0.3–3.5 pF	Variable Capacitor

C4	0.7 pF	Chip Cap
C6, C7	0.1 µF	Capacitor Digi-Key P4917-ND
C9	100 µF	Chip Cap
L1, L2	3 Turn	#20 AWG, .120" I.D.
R1, R2	500 Ω	Resistor
R3	2K	SMT Potentiometer
R4	10 Ω	Chip Resistor K1206
Circuit Board	.028" Dielectric Thickness, ε_r = 4.0, AlliedSignal, G200, 2 oz. copper	



Parts Layout (not to scale)



Artwork (1 inch ——— *)*

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Specifications subject to change without notice.
L3
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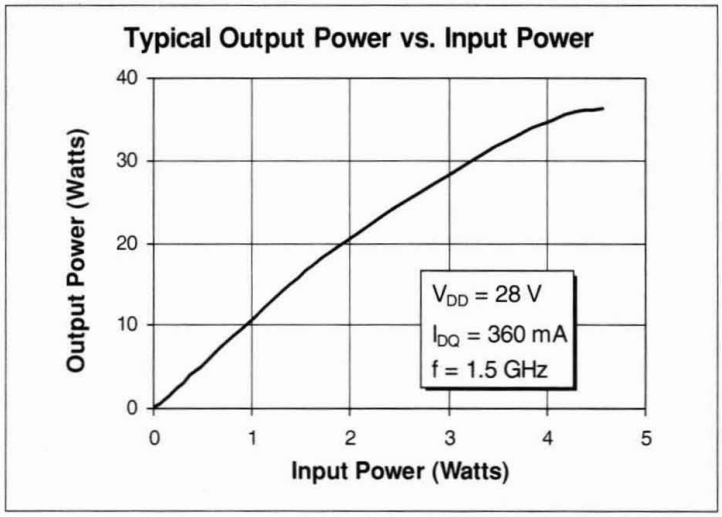
EUS/KR 1301-PTF 10107 Uen Rev. A 02-18-99

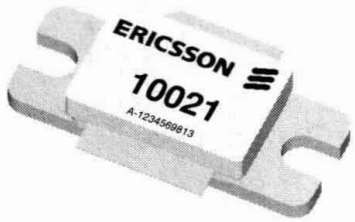
PTF 10021
30 Watts, 1.4–1.6 GHz
GOLDMOS™ Field Effect Transistor

Description

The PTF 10021 is an internally matched common source N-channel enhancement-mode lateral MOSFET intended for linear driver and final applications in the 1.4 to 1.6 GHz range such as DAB/DAR. It is rated at 30 watts power output. Nitride surface passivation and full gold metallization ensure excellent device lifetime and reliability.

- ***INTERNALLY MATCHED***
- **Performance at 1.5 GHz, 28 Volts**
  - **Output Power = 30 Watts Min**
  - **Power Gain = 13 dB Typ**
  - **Efficiency = 48% Typ**
- **Full Gold Metallization**
- **Silicon Nitride Passivated**
- **Excellent Thermal Stability**
- **100% Lot Traceability**





Package 20237

RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{DD} = 28 V, P_{OUT} = 10 W, I_{DQ} = 360 mA, f = 1.5 GHz)	G_{ps}	11.0	13.0	—	dB
Power Output at 1 dB Compressed (V_{DD} = 28 V, P_{OUT} = 30 W, I_{DQ} = 360 mA, f = 1.5 GHz)	P-1dB	30	—	—	Watts
Drain Efficiency (V_{DD} = 28 V, P_{OUT} = 30 W, I_{DQ} = 360 mA, f = 1.5 GHz)	η	45	48	—	%
Load Mismatch Tolerance (V_{DD} = 28 V, P_{OUT} = 30 W(PEP), I_{DQ} = 360 mA, f = 1.5 GHz— all phase angles at frequency of test)	Ψ	—	—	10:1	—

All published data at T_{CASE} = 25°C unless otherwise indicated.

PTF 10021

ERICSSON

Electrical Characteristics (100% Tested)

Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 25 mA	$V_{(BR)DSS}$	65	—	—	Volts
Drain-Source Leakage Current	V_{DS} = 28 V, V_{GS} = 0 V	I_{DSS}	—	—	1.0	mA
Gate Threshold Voltage	V_{DS} = 10 V, I_D = 75 mA	$V_{GS(th)}$	3.0	—	5.0	Volts
Forward Transconductance	V_{DS} = 10 V, I_D = 3 A	g_{fs}	—	2.2	—	Siemens

Maximum Ratings

Parameter	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	65	Vdc
Gate-Source Voltage	V_{GS}	±20	Vdc
Operating Junction Temperature	T_J	200	°C
Total Device Dissipation at Above 25°C derate by	P_D	105 0.6	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{CASE} = 70°C)	$R_{\theta JC}$	1.65	°C/W

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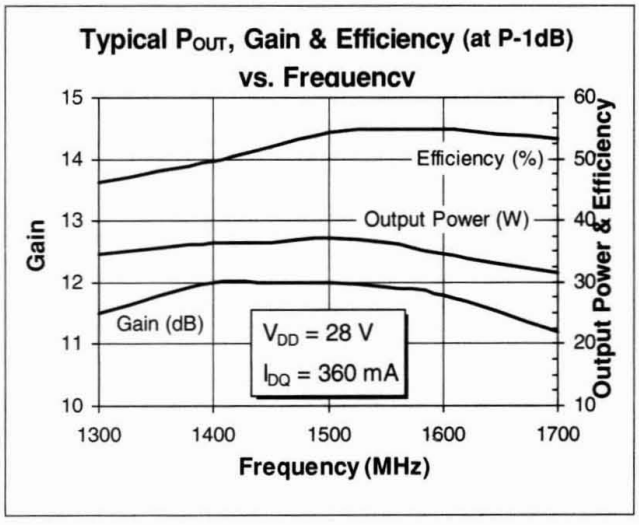
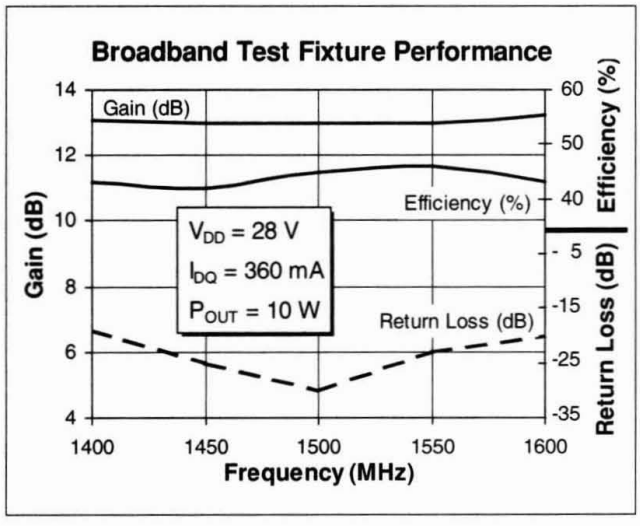
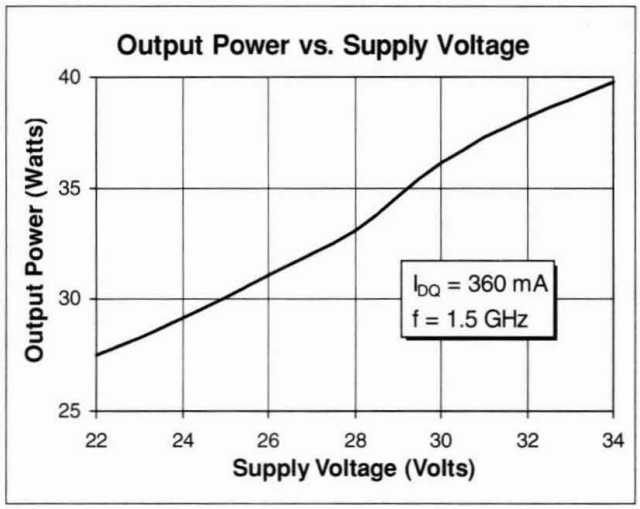
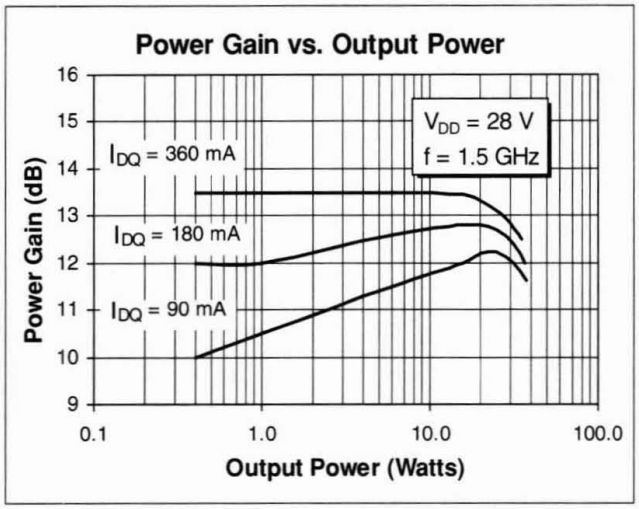
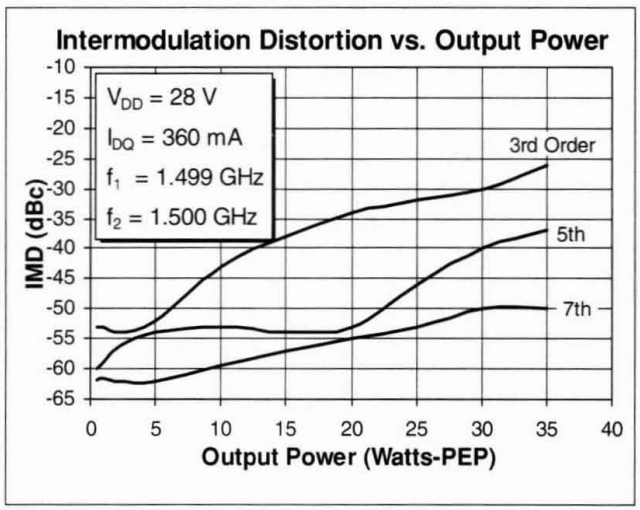
Typical Performance

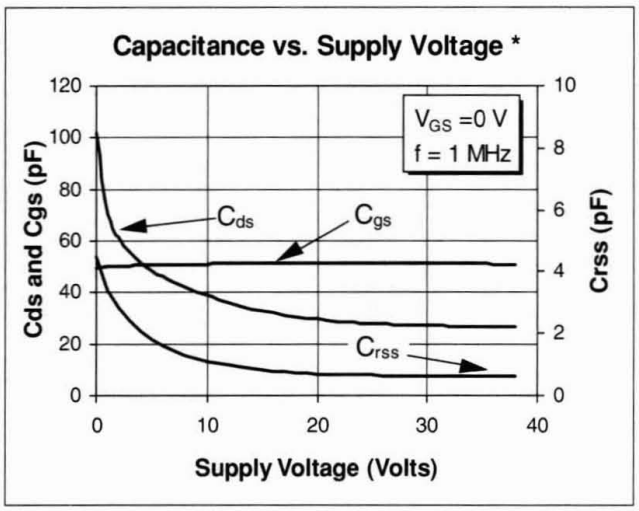


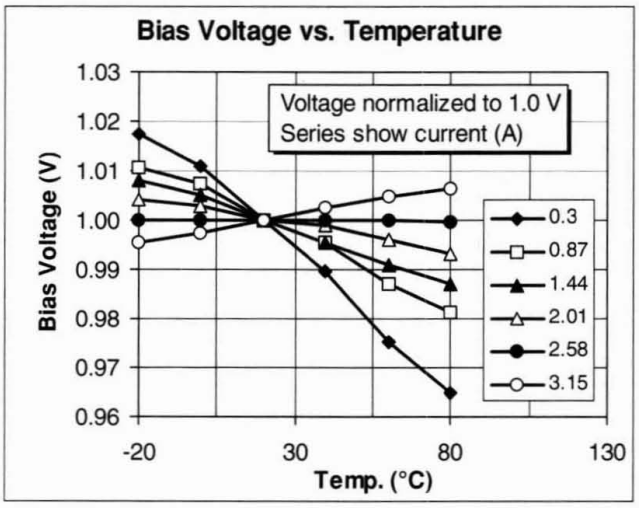








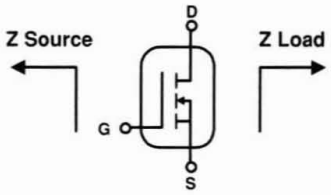


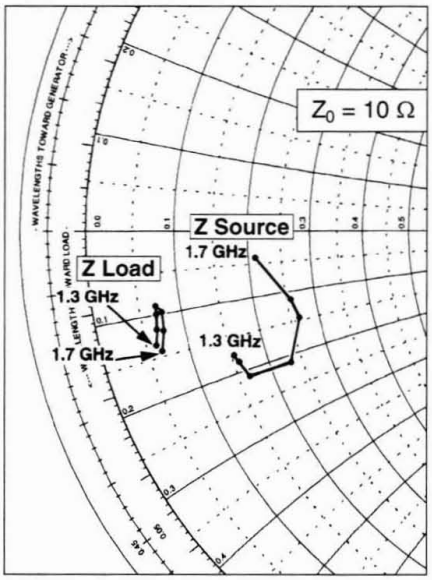


*This part is internally matched. Measurements of the finished product will not yield these figures.

Impedance Data

V_{DD} = 28 V, P_{OUT} = 30 W, I_{DQ} = 360 mA





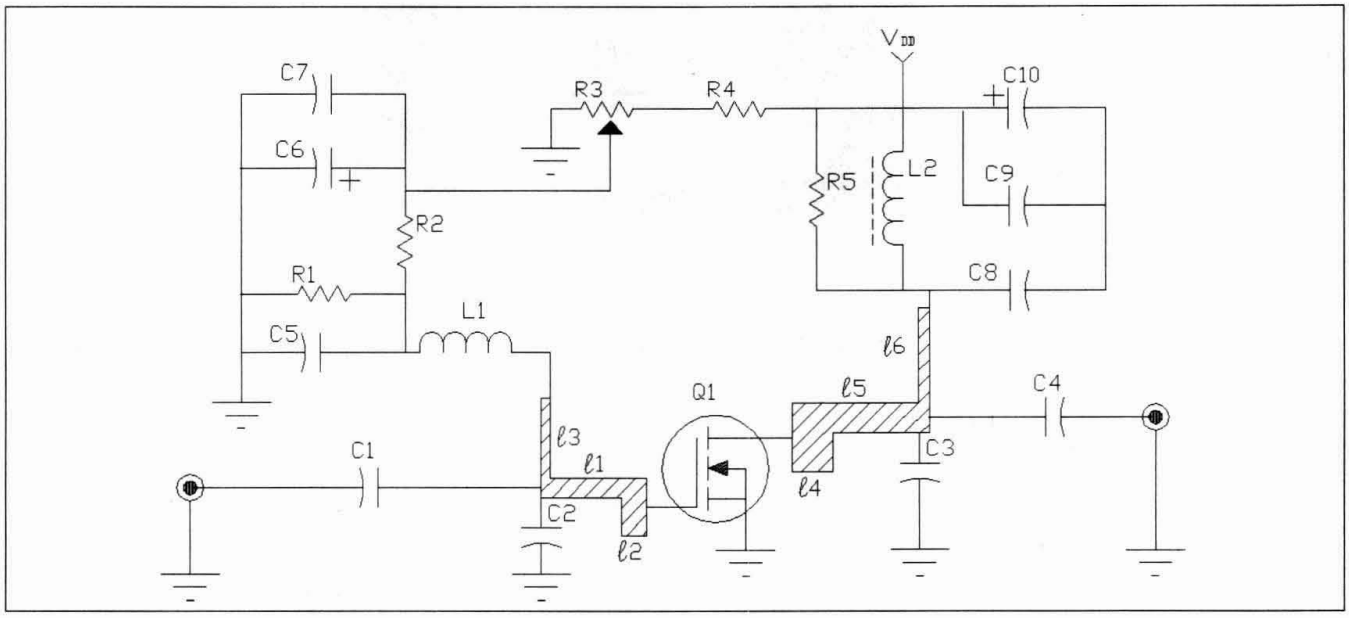
Frequency	Z Source Ω		Z Load Ω	
GHz	R	jX	R	jX
1.30	7.70	-8.77	3.08	-6.77
1.40	7.90	-9.30	3.32	-5.89
1.45	8.30	-10.52	3.45	-5.00
1.50	11.60	-10.60	3.50	-4.50
1.55	13.30	-7.30	3.80	-4.90
1.60	12.90	-5.70	3.70	-6.00
1.70	10.50	-2.07	3.30	-7.16

Typical Scattering Parameters

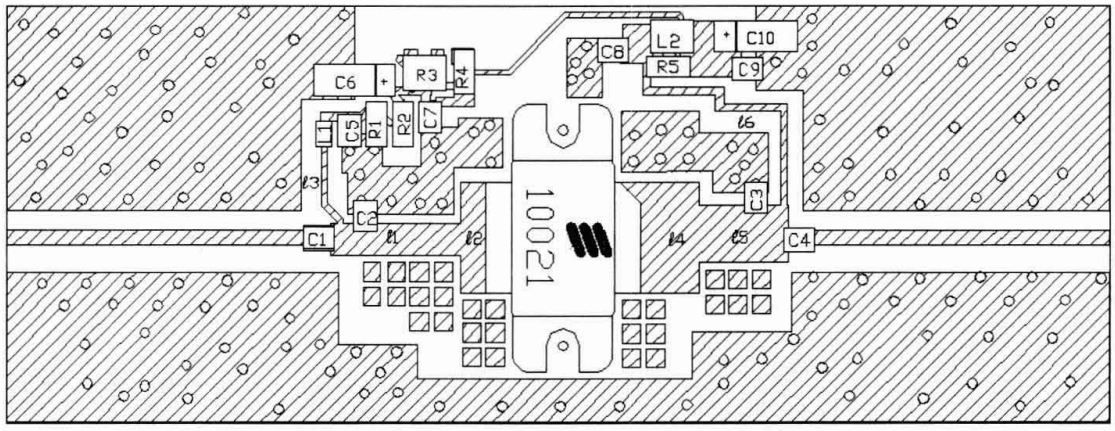
(V_{DS} = 28 V, I_D = 900 mA)

f	S11		S21		S12		S22	
(MHz)	Mag	Ang	Mag	Ang	Mag	Ang	Mag	Ang
100	0.938	-150.8	4.529	35.0	0.0012	84.1	0.813	-162.
200	0.949	-156.9	3.199	31.9	0.0021	92.3	0.839	-166.
300	0.988	-169.3	0.825	12.0	0.0046	95.2	0.893	-172.
400	0.993	-174.7	0.325	5.8	0.0068	92.8	0.929	-176.
500	0.993	-178.1	0.108	9.3	0.0093	90.5	0.943	-179.
600	0.991	179.0	0.047	127.9	0.0123	86.2	0.981	177.7
700	0.990	176.6	0.154	150.5	0.0150	81.9	1.000	172.2
800	0.993	174.3	0.262	149.2	0.0177	77.9	0.947	167.8
900	0.998	171.7	0.393	145.6	0.0212	74.6	0.915	165.2
1000	0.999	168.6	0.586	140.5	0.0257	69.1	0.883	162.8
1100	1.000	164.8	0.927	132.9	0.0312	61.2	0.874	159.9
1200	0.996	158.8	1.662	120.1	0.0383	51.9	0.846	152.3
1300	0.898	145.7	3.504	84.7	0.0521	27.0	0.632	135.8
1400	0.590	144.7	4.350	30.7	0.0454	-12.0	0.259	160.0
1500	0.443	171.8	4.857	-15.9	0.0316	-57.1	0.472	-156.
1600	0.655	-175.3	3.876	-68.4	0.0090	-146.3	0.817	-170.
1700	0.747	-176.7	2.729	-102.8	0.0119	113.0	0.853	179.6
1800	0.831	-178.1	1.930	-132.0	0.0190	88.8	0.855	174.9
1900	0.904	178.4	1.315	-155.7	0.0263	74.8	0.859	171.6
2000	0.944	174.2	0.897	-172.8	0.0303	60.6	0.861	168.7
2100	0.966	170.6	0.641	175.3	0.0299	49.6	0.860	166.2
2200	0.990	167.3	0.491	166.2	0.0283	50.1	0.877	163.7

Test Circuit

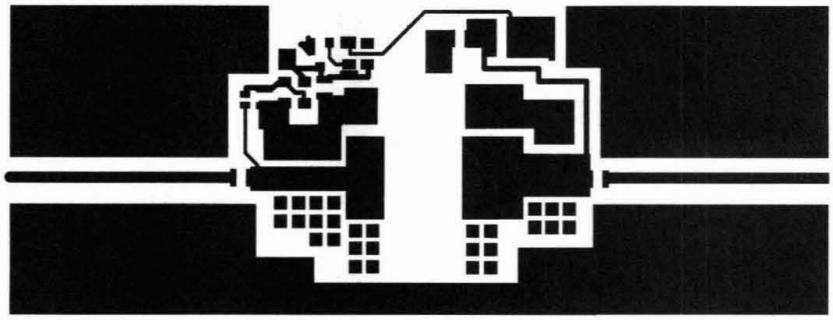


Schematic for f = 1.5 GHz



Placement Diagram (not to scale)

Q1	PTF 10021	Field Effect Transistor
ℓ1	0.11 λ 1.5 GHz	Microstrip 30.21 Ω
ℓ2	0.0483 λ 1.5 GHz	Microstrip 11.69 Ω
ℓ3	0.07 λ 1.5 GHz	Microstrip 70 Ω
ℓ4	0.0853 λ 1.5 GHz	Microstrip 11.69 Ω
ℓ5	0.07 λ 1.5 GHz	Microstrip 21 Ω
ℓ6	0.25 λ 1.5 GHz	Microstrip 70 Ω
C1	33 pF	Chip Cap ATC 100 B
C2	1.3 pF	Chip Cap ATC 100 B
C3	0.7 pF	Chip Cap ATC 100 B
C4, C5	33 pF	Chip Cap ATC 100 B
C6	10 uF	SMT Tantalum
C7	0.1 uF	Chip Cap
C8	33 pF	Chip Cap ATC 100 B
C9	0.1 uF	Chip Cap
C10	10 uF	SMT Tantalum
L1	2.7 nH	SMT Coil
L2		4mm Ferrite Bead
R1	220 Ω	K 1206 SMT
R2	220 Ω	K 1206 SMT
R3	2 KΩ	SMT Pot
R4	470 Ω	K 1206 SMT
R5	2.2 Ω	K 1206 SMt
Circuit Board		.028" Dielectric Thickness, ε_r = 4.0, AlliedSignal, G200, 2 oz. copper
Circuit Board		



Artwork (1 inch)

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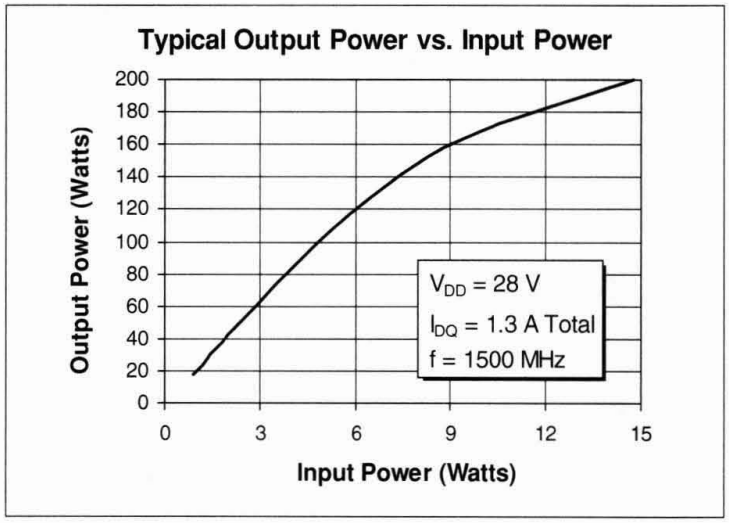
EUS/KR 1301-PTF 10021 Uen Rev. A 11-23-98

PTF 10125
135 Watts, 1.4–1.6 GHz
GOLDMOS™ Field Effect Transistor

Description

The PTF 10125 is an internally matched, common source N-channel enhancement-mode lateral MOSFET intended for linear driver and final applications from 1.4 to 1.6 GHz, such as DAB/DRB. It is rated at 135 watts minimum power outpt. Nitride surface passivation and full gold metallization ensure excellent device lifetime and reliability.

- ***INTERNALLY MATCHED***
- **Performance at 1.5 GHz, 28 V**
  - **Output Power = 135 Watts Min**
  - **Power Gain = 12.5 dB Typ**
- **Full Gold Metallization**
- **Silicon Nitride Passivated**
- **Back Side Common Source**
- **Excellent Thermal Stability**
- **100% Lot Traceability**



Package 20250

RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{DD} = 28 V, P_{OUT} = 30 W, I_{DQ} = 1.3 A Total, f = 1.50, 1.55 GHz)	G_{ps}	11.5	12.5	—	dB
Power Output at 1 dB Compression (V_{DD} = 28 V, I_{DQ} = 1.3 A Total, f = 1.50, 1.55 GHz)	P-1dB	135	150	—	Watts
Drain Efficiency (V_{DD} = 28 V, P_{OUT} = 135 W, I_{DQ} = 1.3 A Total, f = 1.5 GHz)	η_D	35	40	—	%
Load Mismatch Tolerance (V_{DD} = 28 V, P_{OUT} = 67.5 W, I_{DQ} = 1.3 A Total, f = 1.5 GHz —all phase angles at frequency of test)	Ψ	—	—	10:1	—

All published data at T_{CASE} = 25°C unless otherwise indicated.

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PTF 10125

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Electrical Characteristics (100% Tested—characteristics, conditions and limits shown per side)

Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 100 mA	$V_{(BR)DSS}$	65	—	—	Volts
Zero Gate Voltage Drain Current	V_{DS} = 28 V, V_{GS} = 0 V	I_{DSS}	—	—	5.0	mA
Gate Threshold Voltage	V_{DS} = 10 V, I_D = 150 mA	$V_{GS(th)}$	3.0	—	5.0	Volts
Forward Transconductance	V_{DS} = 10 V, I_D = 6 A	g_{fs}	2.0	4.0	—	Siemens

Maximum Ratings

Parameter	Symbol	Value	Unit
Drain-Source Voltage (1)	V_{DSS}	65	Vdc
Gate-Source Voltage (1)	V_{GS}	±20	Vdc
Operating Junction Temperature	T_J	200	°C
Total Device Dissipation Above 25°C derate by	P_D	440 2.51	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{CASE} = 70°C)	$R_{\theta JC}$	0.39	°C/W

(1)per side

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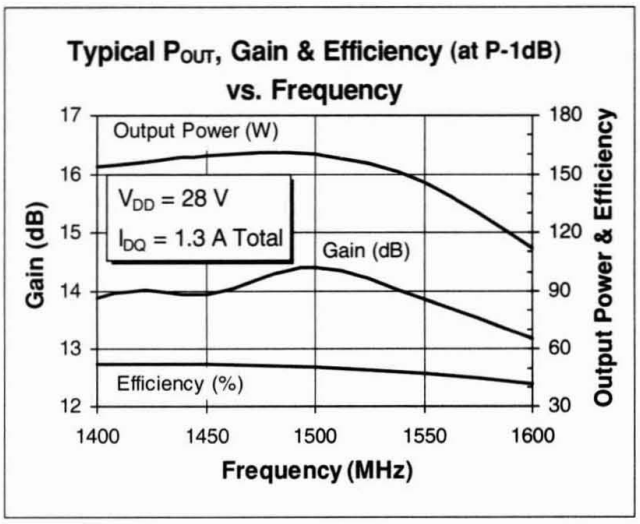
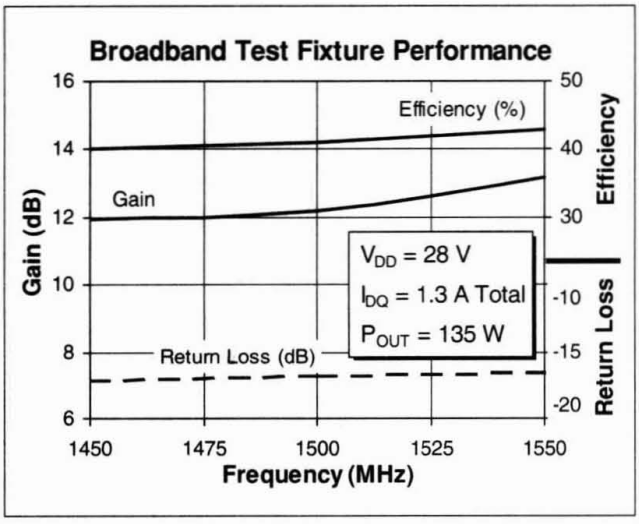
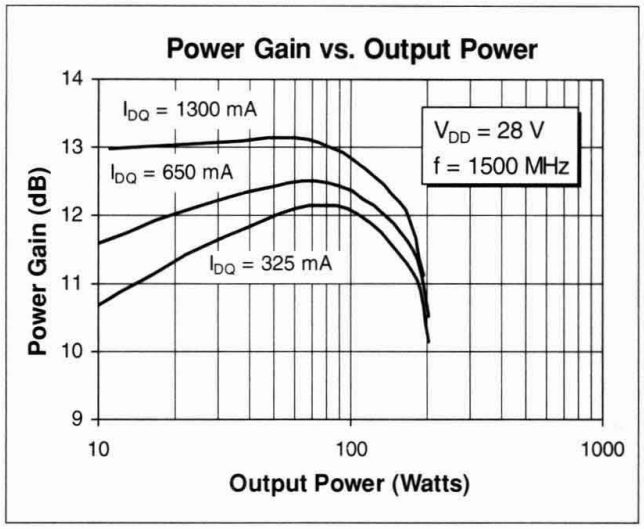
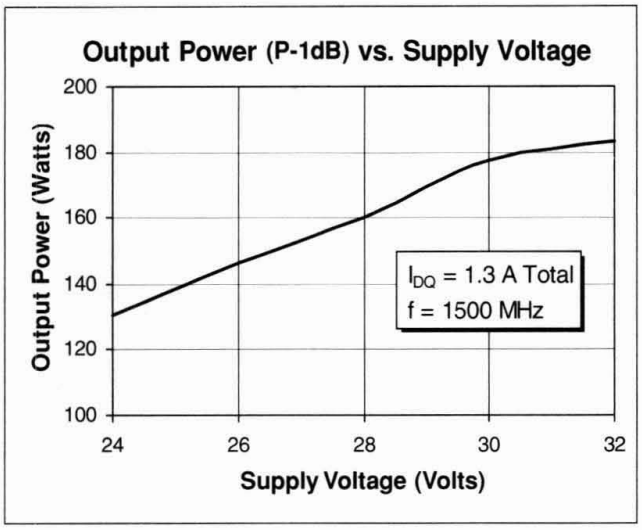
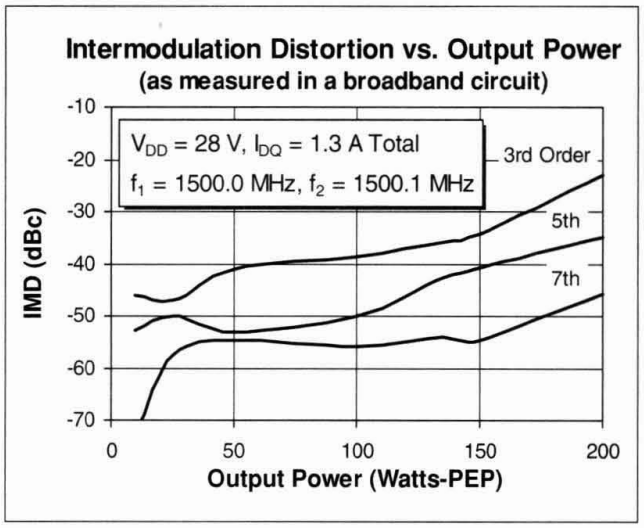
Typical Performance

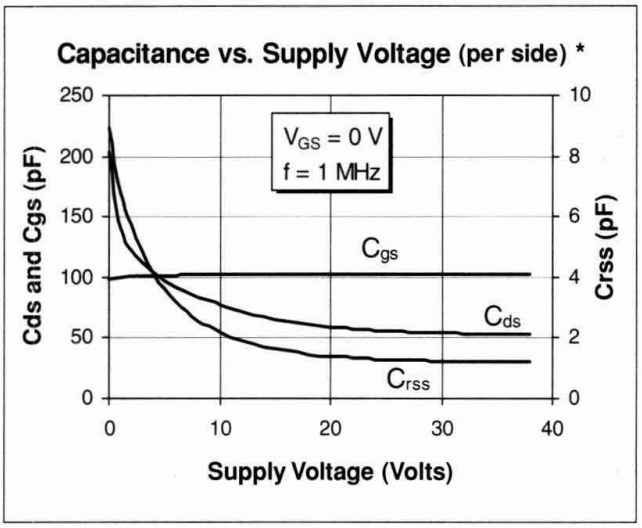




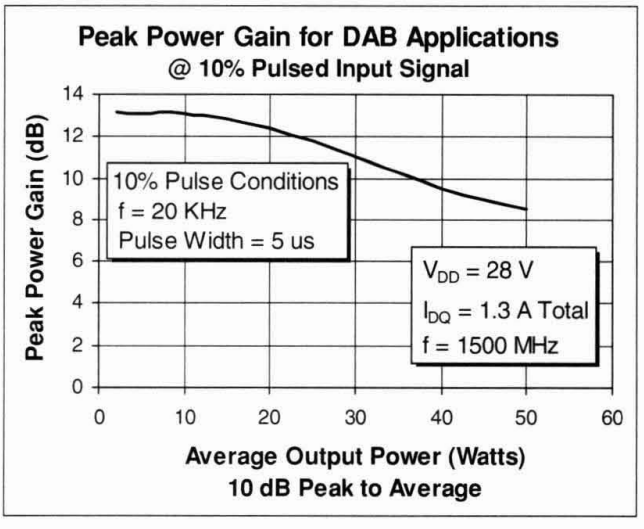


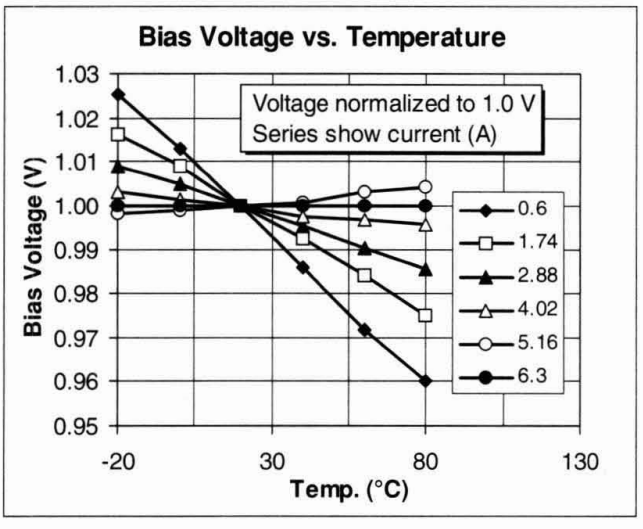






* This part is internally matched. Measurements of the finished product will not yield these results.





PTF 10125

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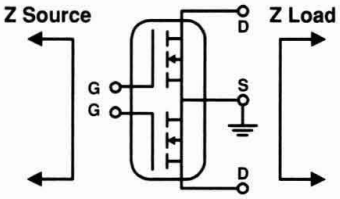
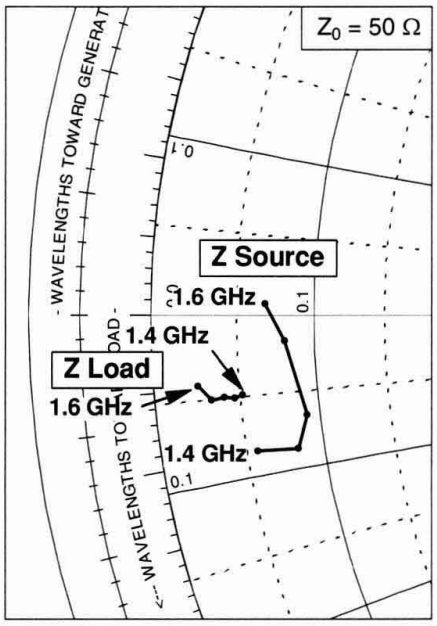
Impedance Data

(V_{DD} = 28 V, P_{OUT} = 135 W,
I_{DQ} = 1.3 A Total)



Frequency	Z Source Ω		Z Load Ω	
GHz	R	jX	R	jX
1400	2.85	-4.23	2.60	-2.46
1450	4.16	-4.36	2.36	-2.53
1500	4.58	-3.30	2.04	-2.48
1550	4.02	-0.83	1.63	-2.52
1600	3.41	0.37	1.27	-2.08



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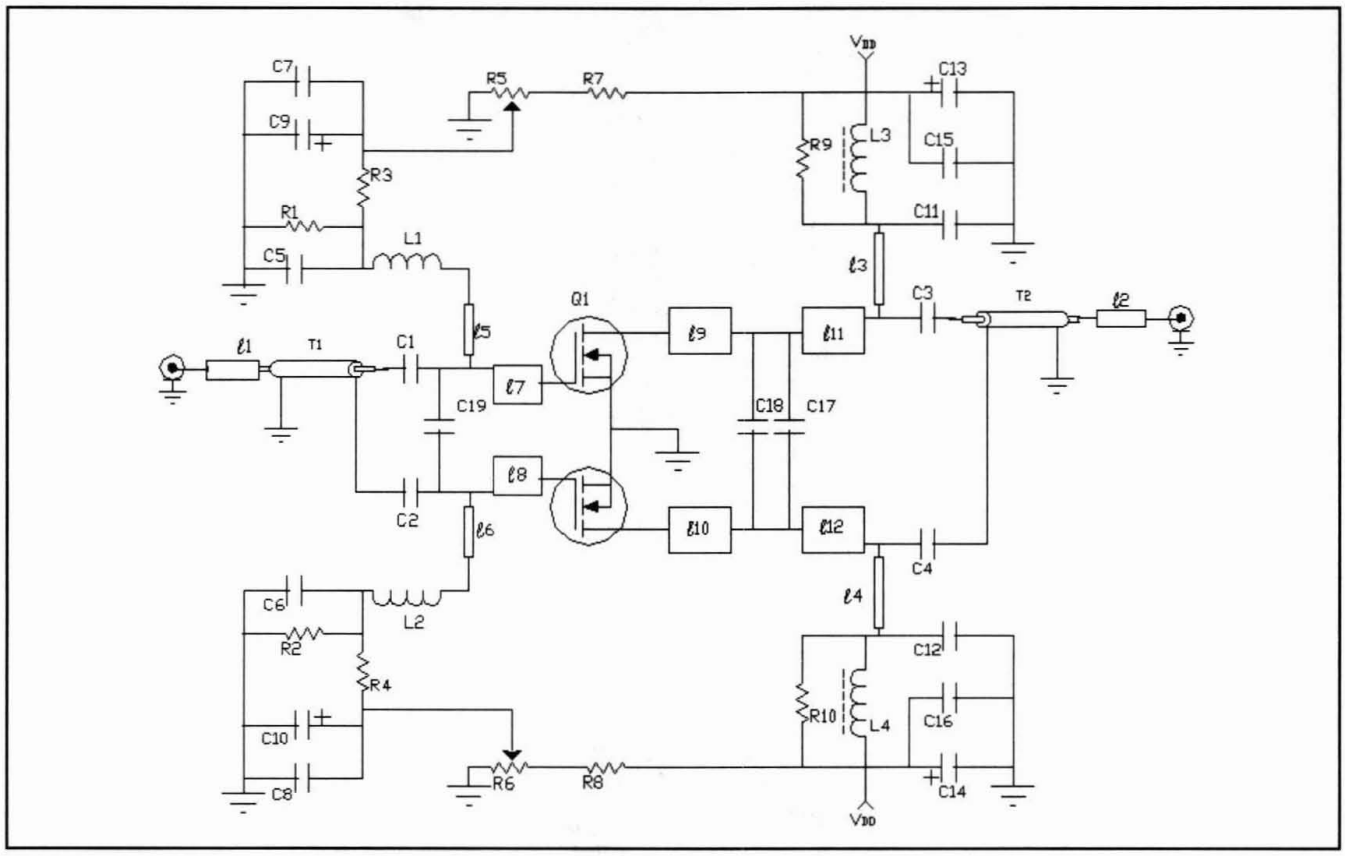
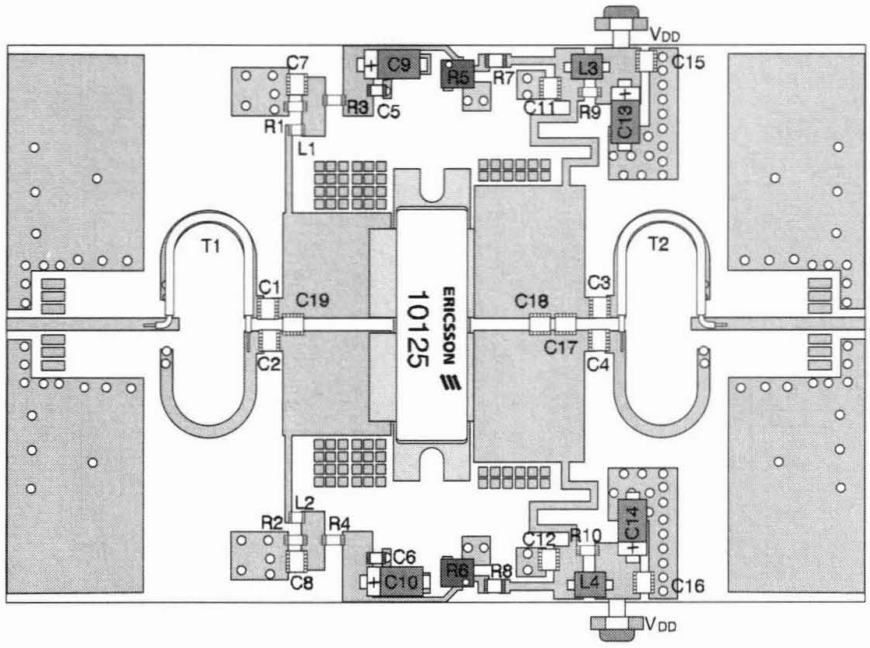
Test Circuit



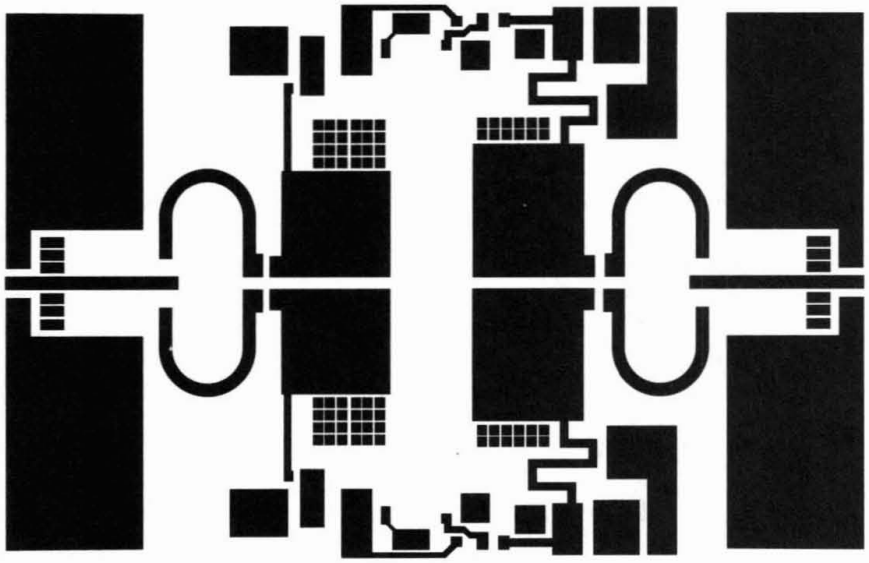
Test Circuit Block Diagram for f = 1.5 GHz

Q1	PTF 10125	LDMOS RF Transistor
ℓ1, ℓ2		Microstrip 50 Ω
ℓ3, ℓ4	.25 λ @ 1.5 GHz	Microstrip 70 Ω
ℓ5, ℓ6	.08 λ @ 1.5 GHz	Microstrip 80 Ω
ℓ7, ℓ8	.138 λ @ 1.5 GHz	Microstrip 9.5 Ω
ℓ9, ℓ10	.096 λ @ 1.5 GHz	Microstrip 7.7 Ω
ℓ11, ℓ12	.045 λ @ 1.5 GHz	Microstrip 7.7 Ω
C1, C2, C3, C4, C7, C8, C11, C12	13 pF Chip Cap	ATC 100 B
C5, C6, C15, C16	0.1 µF Chip Cap	K1206
C9, C10, C13, C14	10 µF SMT Tantalum Cap	
C17, C19	2.0 pF Chip Cap	ATC 100 B
C18	0.3 pF Chip Cap	ATC 100 B

L1, L2	2.7 nh SMT Coil	
L3, L4	4 mm SMT Ferrite Bead	
R1, R2, R3, R4	220 Ω Chip Resistor	K1206
R5, R6	2K SMT Potentiometer	
R7, R8	10 Ω Chip Resistor	K1206
R9, R10	1 Ω Chip Resistor	K1206
T1, T2	50 Ω Coaxial Balun	
Circuit Board	.028" Dielectric Thickness, ε_r = 4.0, AlliedSignal, G200, 2 oz. copper	



Parts Layout (not to scale)



Artwork (1 inch ——— *)*

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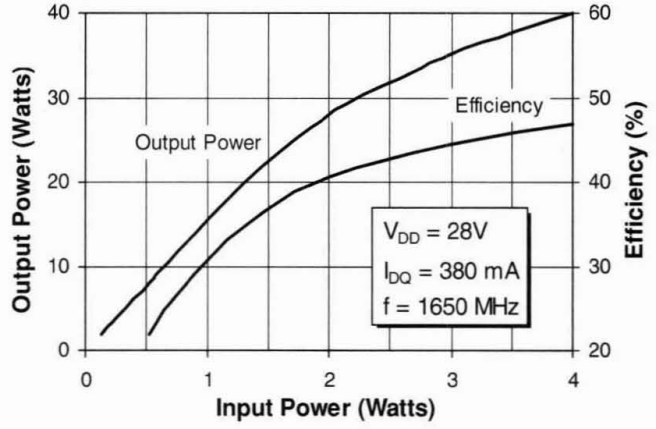
PTF 10045
30 Watts, 1.60–1.65 GHz
GOLDMOS™ Field Effect Transistor

Description

The PTF 10045 is a common source N-channel enhancement-mode lateral MOSFET intended for large signal amplifier applications to 1.65 GHz. It is rated at 30 watts power output. Nitride surface passivation and gold metallization ensure excellent device lifetime and reliability.

- **Performance at 1650 MHz, 28 Volts**
  - **Output Power = 30 Watts**
  - **Power Gain = 11.5 dB Typ**
- **Full Gold Metallization**
- **Silicon Nitride Passivated**
- **Excellent Thermal Stability**
- **Back Side Common Source**
- **100% Lot Traceability**

Typical Output Power and Efficiency vs. Input Power



Package 20222

Maximum Ratings

Parameter	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	65	Vdc
Gate-Source Voltage	V_{GS}	±20	Vdc
Operating Junction Temperature	T_J	200	°C
Total Device Dissipation at T_{flange} = 25°C Above 25°C derate by	P_D	120 0.7	Watts W/°C
Storage Temperature	T_{STG}	150	°C
Thermal Resistance (T_{flange} = 70°C)	$R_{\theta JC}$	1.4	°C/W

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Electrical Characteristics (100% Tested)

Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 25 mA	$V_{(BR)DSS}$	65	—	—	Volts
Drain-Source Leakage Current	V_{DS} = 28 V, V_{GS} = 0 V	I_{DSS}	—	—	1.0	mA
Gate Threshold Voltage	V_{DS} = 10 V, I_D = 75 mA	$V_{GS(th)}$	3.0	—	5.0	Volts
Forward Transconductance	V_{DS} = 10 V, I_D = 3 A	g_{fs}	—	2.0	—	Siemens

RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Common Source Power Gain (V_{DD} = 28 V, P_{OUT} = 30 W, I_{DQ} = 380 mA, f = 1650 MHz)	G_{ps}	10.0	11.5	—	dB
Power Output at 1 dB Compression (V_{DD} = 28 V, I_{DQ} = 380 mA, f = 1650 MHz)	P-1dB	30	35	—	Watts
Drain Efficiency (V_{DD} = 28 V, P_{OUT}= 30 W, I_{DQ} = 380 mA, f = 1650 MHz)	η	40	43	—	%
Load Mismatch Tolerance (V_{DD} = 28 V, P_{OUT} = 30 W, I_{DQ} = 380 mA, f = 1650 MHz— all phase angles at frequency of test)	Ψ	—	—	10:1	—

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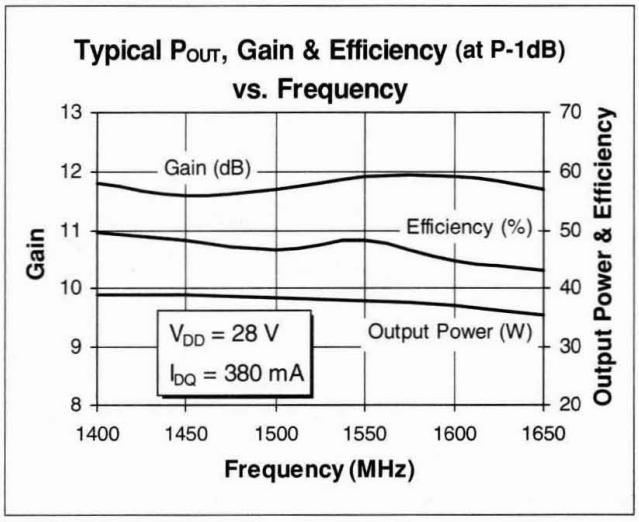
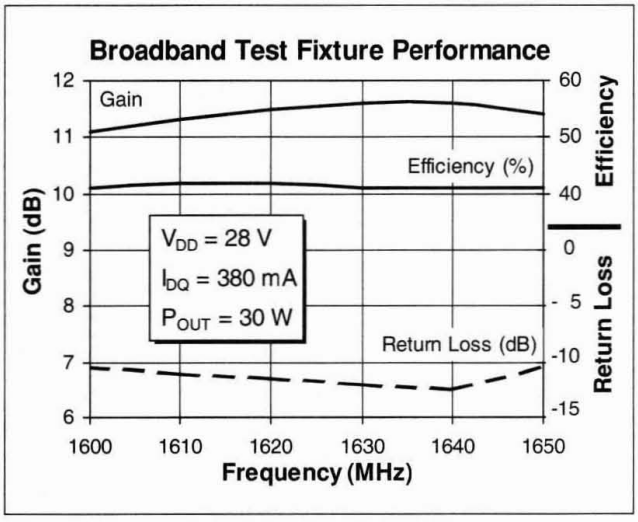
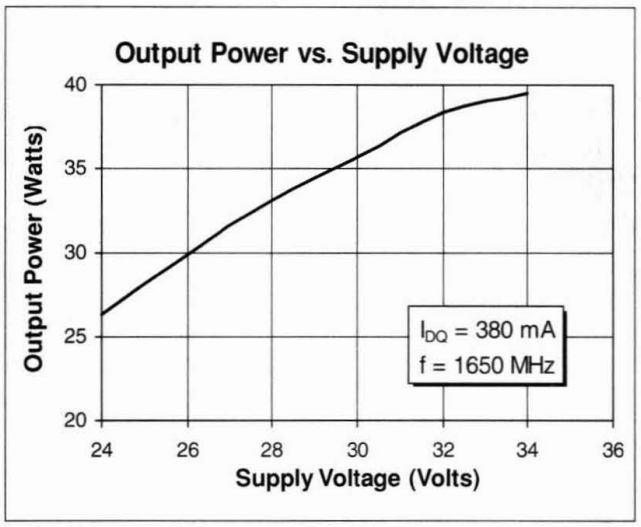
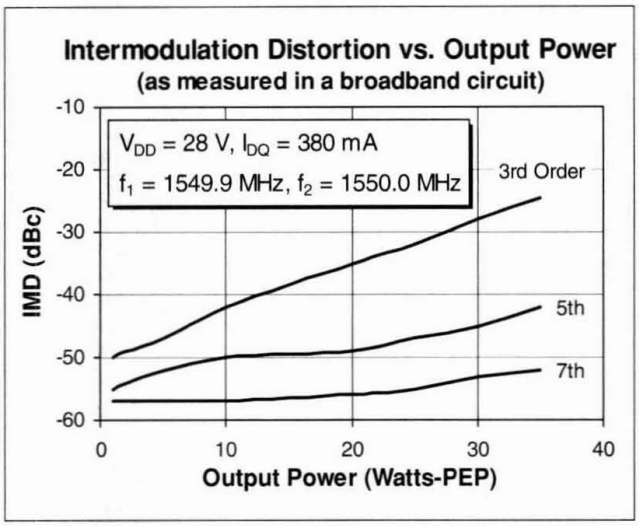
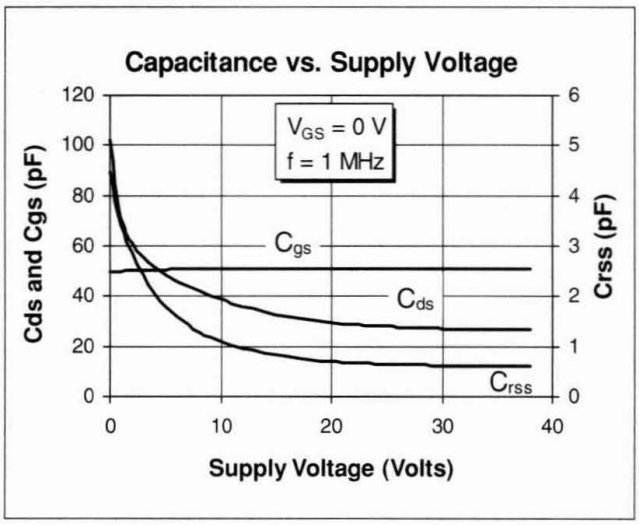
Typical Performance

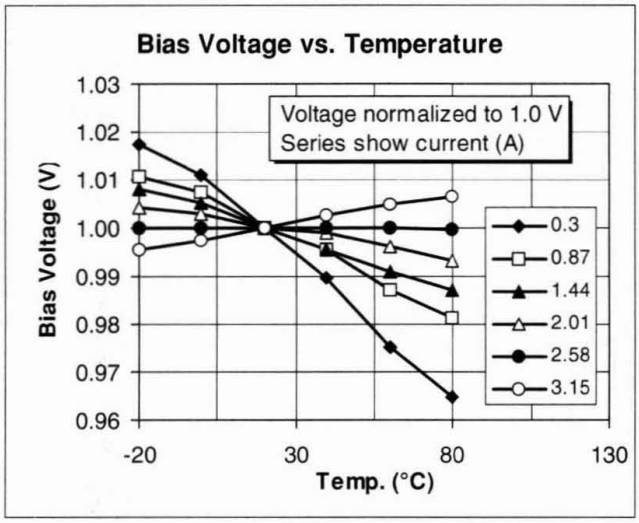






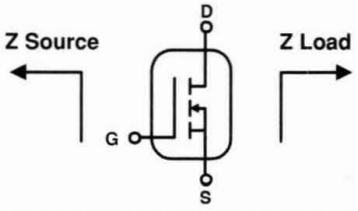

Intermodulation Distortion vs. Output Power
(as measured in a broadband circuit)
IMD (dBc)
Output Power (Watts-PEP)
V_{DD} = 28 V, I_{DQ} = 380 mA
f_1 = 1549.9 MHz, f_2 = 1550.0 MHz
3rd Order
5th
7th



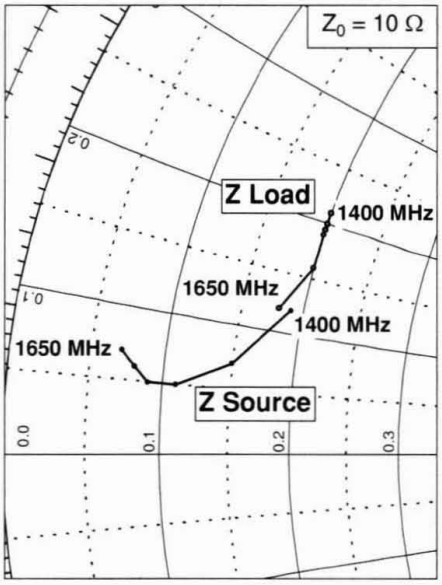


Impedance Data

V_{DD} = 28 V, P_{OUT} = 30 W, I_{DQ} = 380 mA



Frequency	Z Source Ω		Z Load Ω	
MHz	R	jX	R	jX
1400	1.9	1.2	2.0	2.1
1450	1.5	0.7	2.0	2.0
1500	1.1	0.5	2.0	2.0
1550	0.9	0.5	2.0	1.9
1600	0.8	0.6	2.0	1.6
1650	0.7	0.7	1.8	1.2

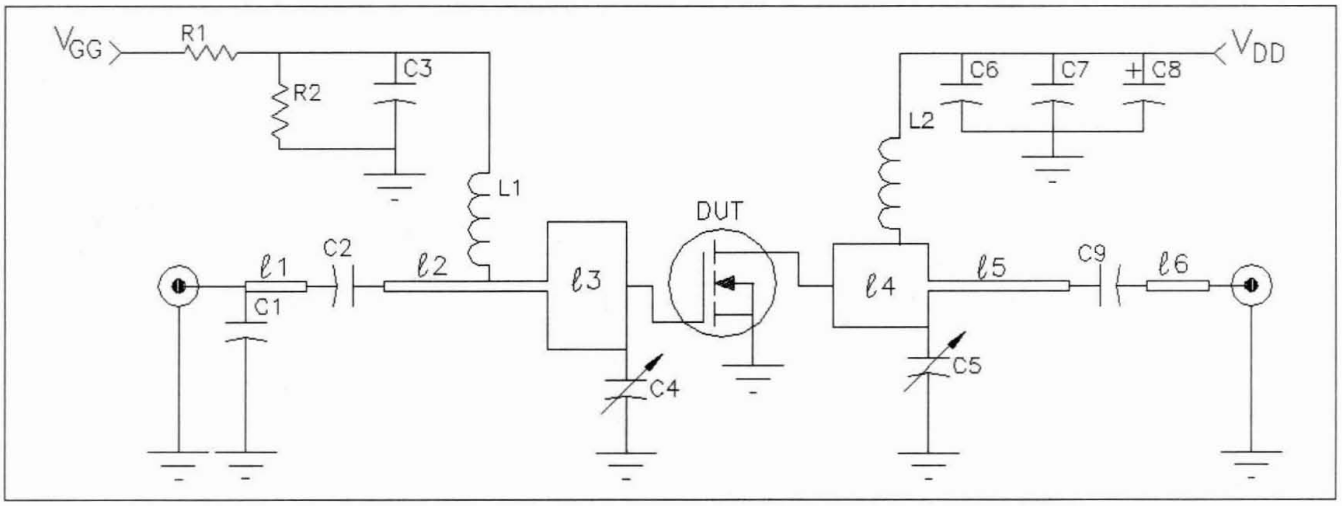


Typical Scattering Parameters

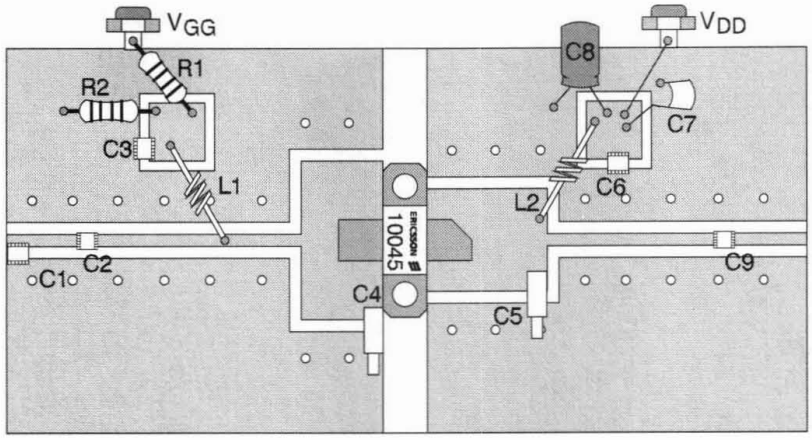
(V_{DS} = 28 V, I_D = 1 A)

f	S11		S21		S12		S22	
(MHz)	Mag	Ang	Mag	Ang	Mag	Ang	Mag	Ang
400	0.933	-169	4.28	37.8	0.005	-18.1	0.833	-154
450	0.933	-170	3.48	32.9	0.004	-10.1	0.859	-157
500	0.951	-171	2.98	33.4	0.003	0.014	0.936	-153
550	0.937	-172	2.63	26.3	0.002	11.2	0.940	-157
600	0.971	-172	2.20	22.6	0.003	41.0	0.924	-161
650	0.952	-175	1.91	20.5	0.003	58.5	0.935	-166
700	0.968	-174	1.76	19.7	0.004	71.2	0.946	-165
750	0.949	-176	1.49	11.5	0.005	66.9	0.946	-171
800	0.975	-175	1.30	13.0	0.006	77.9	0.951	-168
850	0.982	-178	1.21	10.4	0.007	78.2	0.945	-172
900	0.964	-176	1.05	9.64	0.007	78.1	0.917	-173
950	0.972	-179	0.923	5.00	0.008	82.7	0.931	-176
1000	0.971	-177	0.887	8.43	0.010	85.2	0.949	-171
1050	0.983	-180	0.793	3.80	0.011	77.2	0.958	-174
1100	0.962	-179	0.736	0.10	0.011	79.0	0.931	-173
1150	0.996	-178	0.672	0.37	0.013	81.5	0.970	-176
1200	0.959	-180	0.642	3.62	0.012	75.5	0.956	-175
1250	0.989	178	0.585	-2.34	0.013	75.4	0.965	-177
1300	0.971	178	0.553	0.68	0.014	76.0	0.961	-176
1350	0.981	178	0.516	-3.51	0.015	75.4	0.967	-177
1400	0.983	177	0.492	-0.82	0.014	71.1	0.977	-178
1450	0.968	177	0.443	-6.53	0.015	78.4	0.952	-178
1500	0.965	176	0.444	-2.30	0.017	74.3	0.985	-179
1550	0.960	176	0.405	-5.00	0.017	78.7	0.962	-180
1600	0.950	176	0.391	-4.08	0.019	76.9	0.998	-180
1650	0.950	174	0.360	-9.41	0.019	81.1	0.950	179
1700	0.950	175	0.365	-6.95	0.022	77.3	0.955	179
1750	0.952	173	0.330	-9.70	0.022	77.9	0.950	178
1800	0.950	175	0.317	-9.64	0.025	79.0	0.960	179
1850	0.954	171	0.299	-11.4	0.026	74.3	0.947	175
1900	0.960	173	0.314	-10.6	0.030	73.5	0.950	177
1950	0.960	170	0.285	-13.8	0.030	64.7	0.948	174
2000	0.960	173	0.290	-13.1	0.034	63.2	0.980	177

Test Circuit

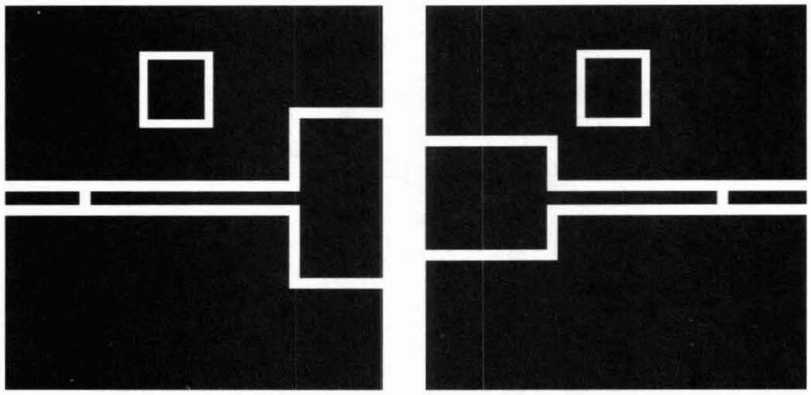


Test Circuit Schematic for f = 1650 MHz



Placement Diagram (not to scale)

DUT	PTF 10045	
$\ell 1$	.090 λ @ 1650 MHz	Microstrip 50 Ω
$\ell 2$	.265 λ @ 1650 MHz	Microstrip 50 Ω
$\ell 5$	.215 λ @ 1650 MHz	Microstrip 50 Ω
$\ell 6$	.100 λ @ 1650 MHz	Microstrip 50 Ω
$\ell 3$	.115 λ @ 1650 MHz	Microstrip 6.4 Ω
$\ell 4$	.170 λ @ 1650 MHz	Microstrip 9.2 Ω
C1	0.6 pF, Capacitor ATC 100 B	
C2, C3, C6, C9	33 pF, Capacitor ATC 100 B	
C4, C5	0.6–3.6 pF, Variable Capacitor, Johanson	
C7	0.1 µF, 50 V, Capacitor Digi-Key P4917-ND	
C8	100 µF, 50 V, Electrolytic Capacitor, Digi-Key P5276	
L1, L2	3 Turn, #20 AWG, .120" I.D.	
R1, R2	220 Ω, 1/4 W Resistor	
Circuit Board	.028" Dielectric Thickness, $\varepsilon_r = 4.0$, AlliedSignal, G200, 2 oz. copper	



Artwork (1 inch ———)

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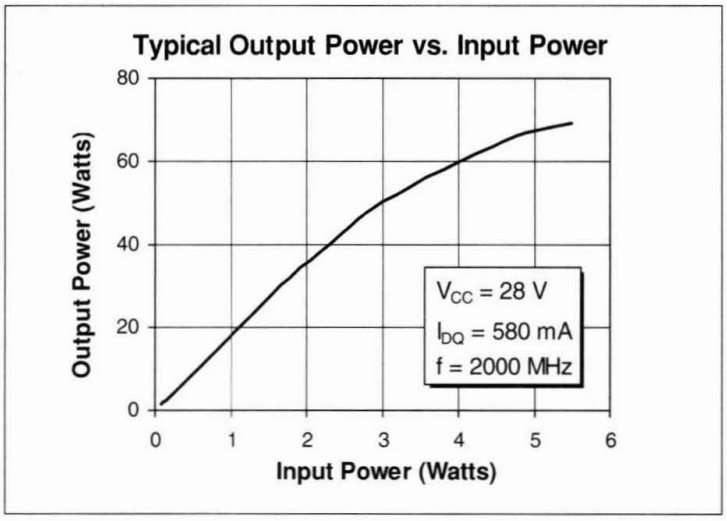
EUS/KR 1301-PTF 10045 Uen Rev. A 01-27-99

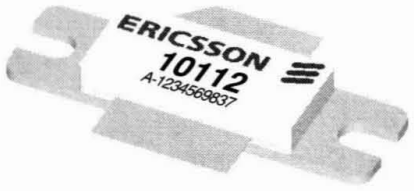
PTF 10112
60 Watts, 1.8–2.0 GHz
GOLDMOS™ Field Effect Transistor

Description

The PTF 10112 is an internally matched common source N-channel enhancement-mode lateral MOSFET intended for CDMA and TDMA applications from 1.8 to 2.0 GHz. It is rated at 60 watts power output. Nitride surface passivation and full gold metallization ensure excellent device lifetime and reliability.

- ***INTERNALLY MATCHED***
- **Guaranteed Performance at 1.93, 1.99 GHz, 28 V**
  - **Output Power = 60 Watts Min**
  - **Power Gain = 12 dB Typ**
- **Full Gold Metallization**
- **Silicon Nitride Passivated**
- **Back Side Common Source**
- **Excellent Thermal Stability**
- **100% Lot Traceability**





Package 20248

RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{DD} = 28 V, P_{OUT} = 15 W, I_{DQ} = 580 mA, f = 1.93, 1.99 GHz)	G_{ps}	11	12	—	dB
Power Output at 1 dB Compression (V_{DD} = 28 V, I_{DQ} = 580 mA, f = 1.99 GHz)	P-1dB	60	—	—	Watts
Drain Efficiency (V_{DD} = 28 V, P_{OUT} = 60 W, I_{DQ} = 580 mA, f = 1.99 GHz)	η_D	—	41	—	%
Load Mismatch Tolerance (V_{DD} = 28 V, P_{OUT} = 60 W, I_{DQ} = 580 mA, f = 1.99 GHz —all phase angles at frequency of test)	Ψ	—	—	10:1	—

All published data at T_{CASE} = 25°C unless otherwise indicated.

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PTF 10112

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Electrical Characteristics (100% Tested)

Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 100 mA	$V_{(BR)DSS}$	65	—	—	Volts
Zero Gate Voltage Drain Current	V_{DS} = 28 V, V_{GS} = 0 V	I_{DSS}	—	—	5.0	mA
Gate Threshold Voltage	V_{DS} = 10 V, I_D = 150 mA	$V_{GS(th)}$	3.0	—	5.0	Volts
Forward Transconductance	V_{DS} = 10 V, I_D = 2 A	g_{fs}	—	4.0	—	Siemens

Maximum Ratings

Parameter	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	65	Vdc
Gate-Source Voltage	V_{GS}	±20	Vdc
Operating Junction Temperature	T_J	200	°C
Total Device Dissipation at Above 25°C derate by	P_D	237 1.35	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{CASE} = 70°C)	$R_{\theta JC}$	0.74	°C/W

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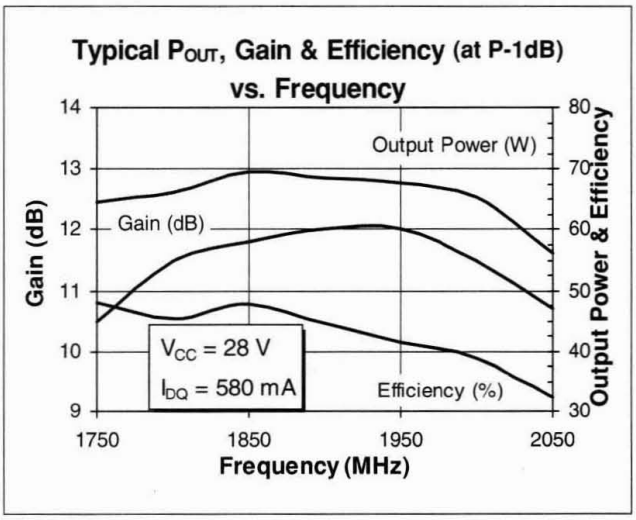
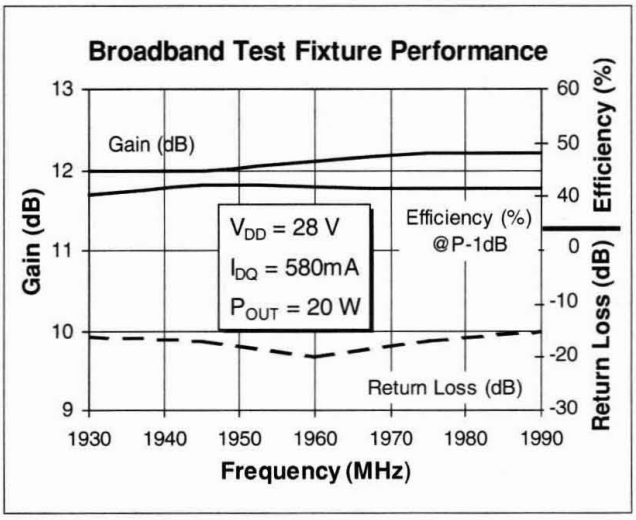
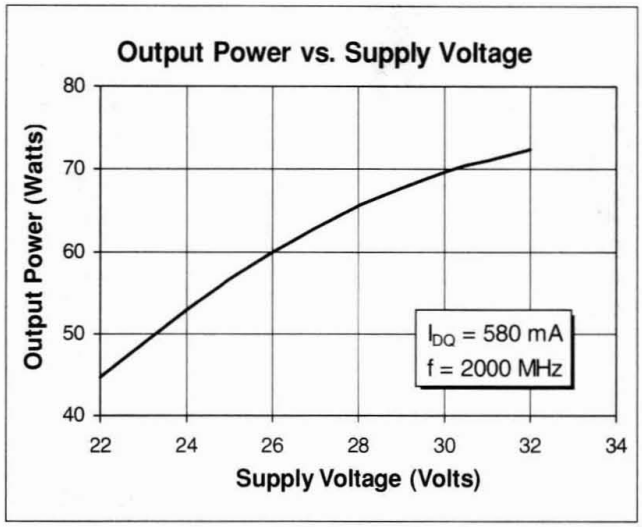
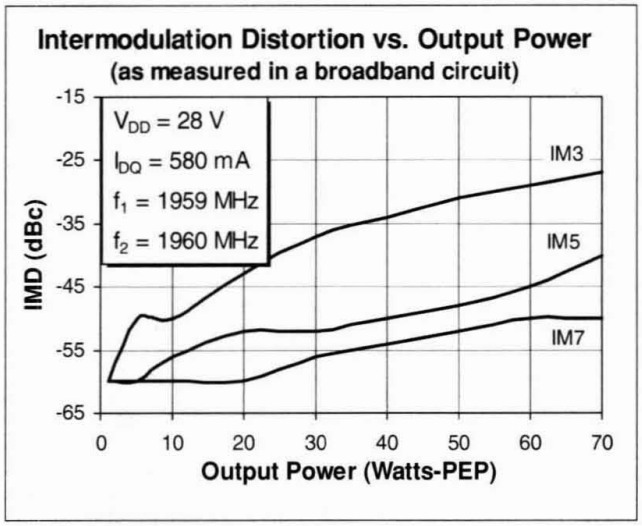
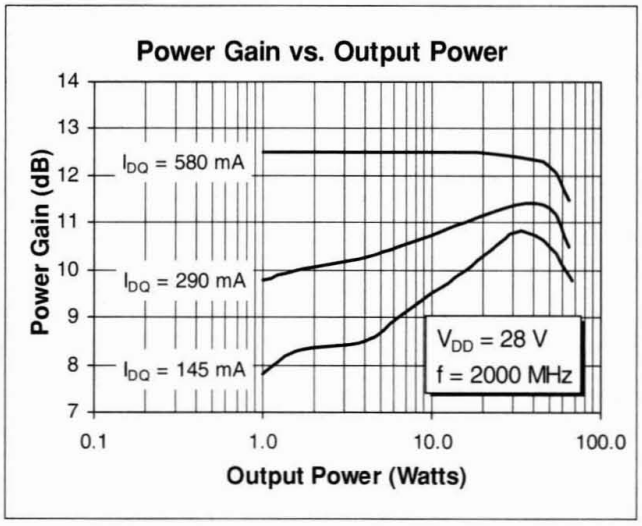
Typical Performance

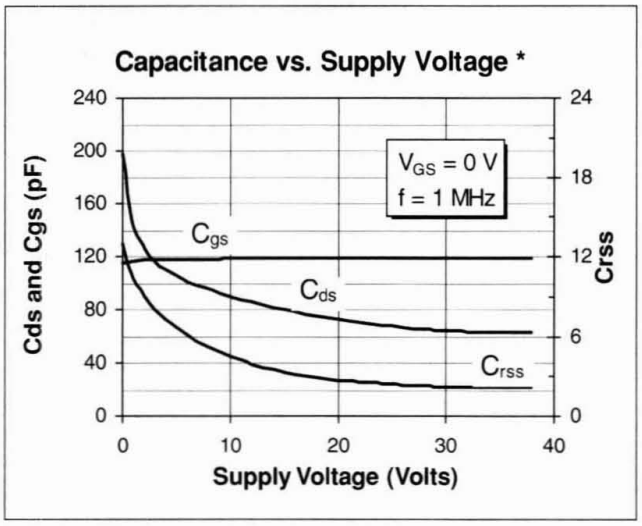




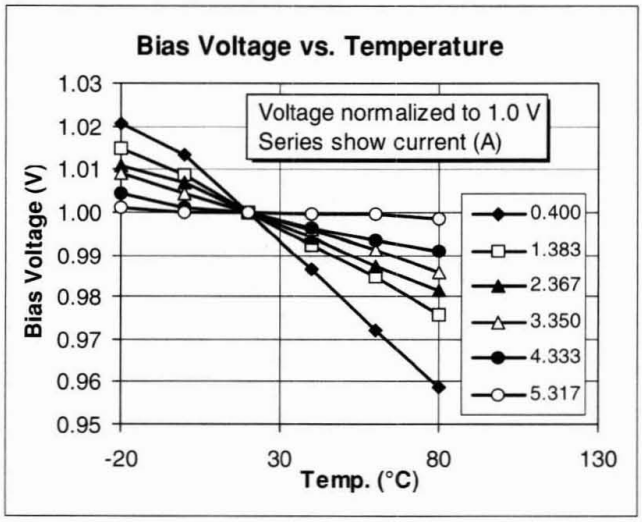








* This part is internally matched. Measurements of the finished product will not yield these results.



PTF 10112

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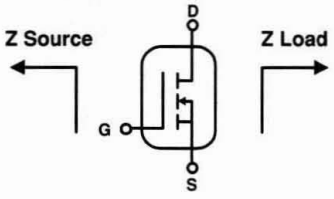
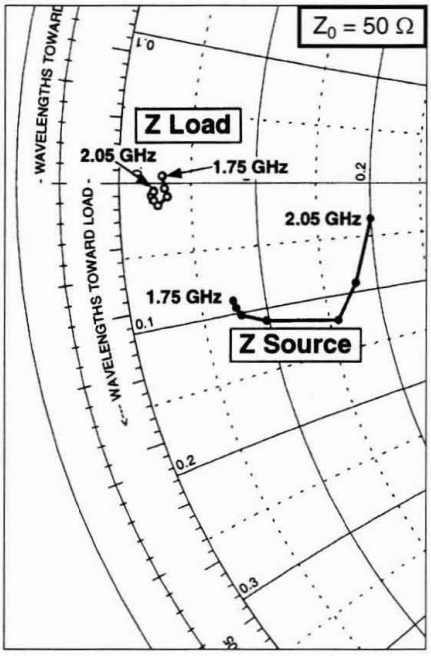
Impedance Data

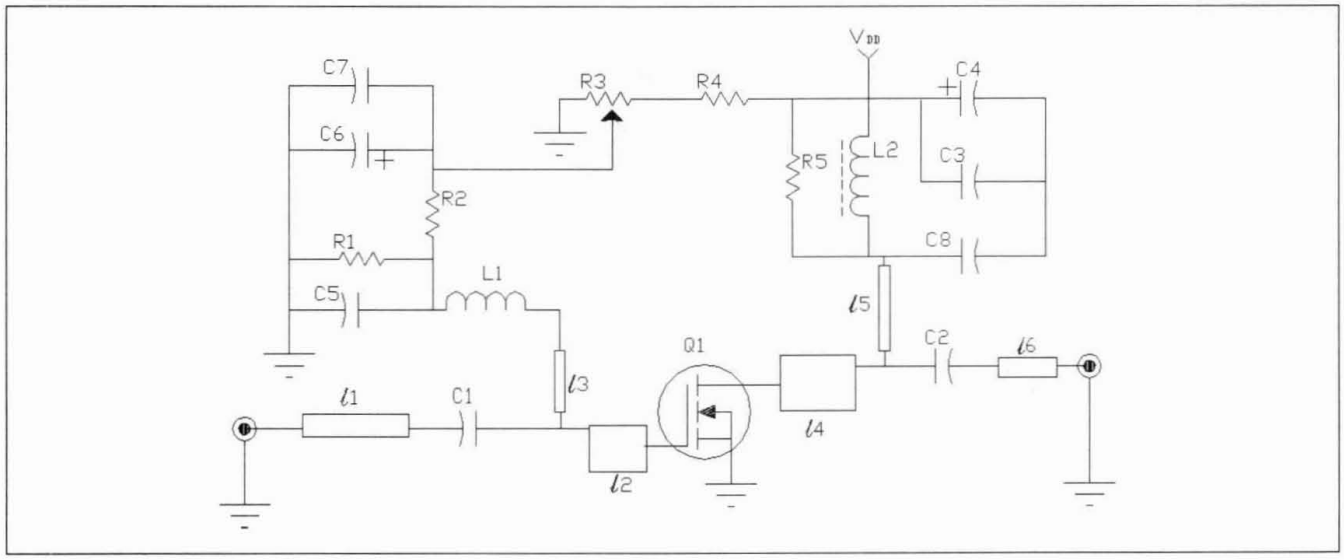
V_{DD} = 28 V, P_{OUT} = 60 W, I_{DQ} = 580 mA





Frequency	Z Source Ω		Z Load Ω	
GHz	R	jX	R	jX
1.75	3.74	-4.50	1.48	0.25
1.80	3.80	-4.80	1.56	-0.20
1.85	3.96	-5.10	1.66	-0.50
1.90	4.90	-5.50	1.32	-0.80
1.95	7.90	-6.10	1.16	-0.60
2.00	9.00	-4.60	1.10	-0.45
2.05	10.00	-1.70	1.18	-0.30

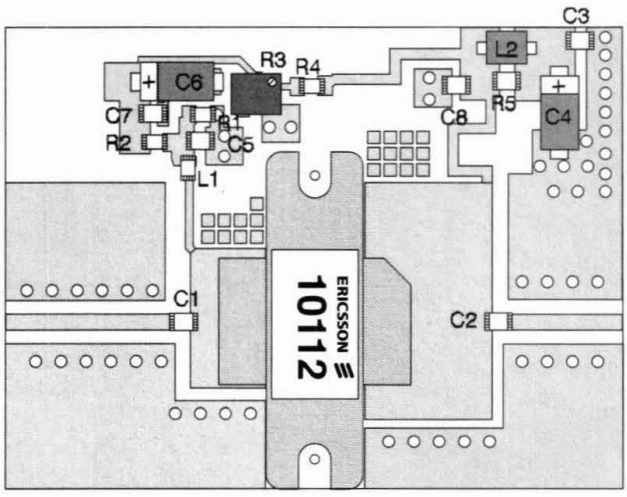
Test Circuit

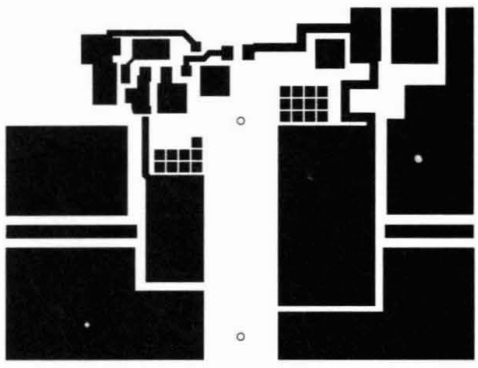


Test Circuit Block Diagram for f = 1.93–1.99 GHz

Q1	PTF 10112	LDMOS RF Transistor
ℓ1, ℓ6		Microstrip 50 Ω
ℓ2	.10 λ @ 2.0 GHz	Microstrip 9.4 Ω
ℓ3	.08 λ @ 2.0 GHz	Microstrip 70 Ω
ℓ4	.162 λ @ 2.0 GHz	Microstrip 5.8 Ω
ℓ5	.22 λ @ 2 GHz	Microstrip 65 Ω
C1, C2, C5, C8	10 pF Chip Cap	ATC 100 B
C3, C7	0.1 μF Chip Cap	
C4, C6	10 μF SMT Tantalum	

L1	2.7 nh	SMT Coil
L2	4mm	SMT Ferrite Bead
R1, R2	220 Ω	Chip Resistor K1206
R3	2K	SMT Potentiometer
R4	10 Ω	Chip Resistor K1206
R5	1 Ω	Chip Resistor K1206
Circuit Board	.028" Dielectric Thickness, ε_r = 4.0, AlliedSignal, G200, 2 oz. copper	





Artwork (1 inch)

Parts Layout (not to scale)

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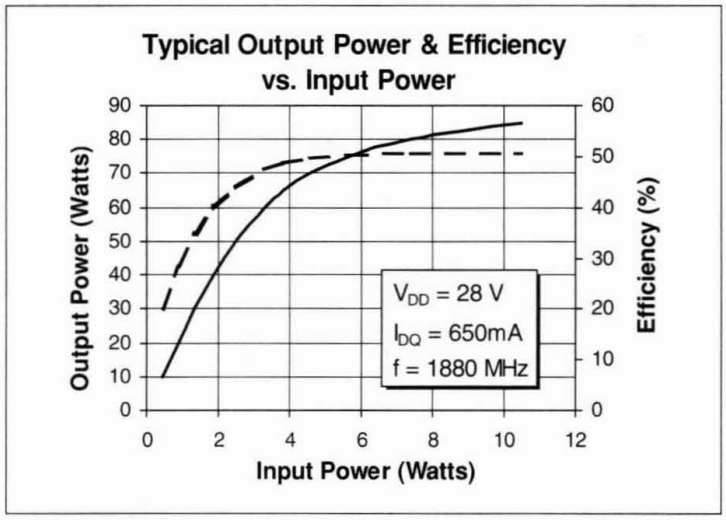
PTF 10153
60 Watts, 1.8–2.0 GHz
GOLDMOS™ Field Effect Transistor

Description

The PTF 10153 is an internally matched common source N-channel enhancement-mode lateral MOSFET intended for CDMA and TDMA applications from 1.8 to 2.0 GHz. It is rated at 60 watts power output. Nitride surface passivation and full gold metallization ensure excellent device lifetime and reliability.



- ***INTERNALLY MATCHED***
- **Guaranteed Performance at 1805, 1843, 1880 MHz, 28 V**
  - **Output Power = 60 Watts Min**
  - **Power Gain = 11.5 dB Min**
- **Full Gold Metallization**
- **Silicon Nitride Passivated**
- **Back Side Common Source**
- **Excellent Thermal Stability**
- **100% Lot Traceability**

Package 20248

RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{DD} = 28 V, P_{OUT} = 60 W, I_{DQ} = 650 mA, f = 1805, 1843, 1880 MHz)	G_{ps}	11.5	—	—	dB
Power Output at 1 dB Compression (V_{DD} = 28 V, I_{DQ} = 650 mA, f = 1880 MHz)	P-1dB	60	—	—	Watts
Drain Efficiency (V_{DD} = 28 V, P_{OUT} = 60 W, I_{DQ} = 650 mA, f = 1805, 1843, 1880 MHz)	η_D	40	—	—	%
Return Loss (V_{DD} = 28 V, P_{OUT} = 60 W, I_{DQ} = 650 mA, f = 1805, 1843, 1880 MHz)	—	—	—	–9.5	dB
Load Mismatch Tolerance (V_{DD} = 28 V, P_{OUT} = 60 W, I_{DQ} = 650 mA, f = 1805 —all phase angles at frequency of test)	Ψ	—	—	10:1	—

All published data at T_{CASE} = 25°C unless otherwise indicated.

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PTF 10153

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Electrical Characteristics (100% Tested)

Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 25 mA	$V_{(BR)DSS}$	65	—	—	Volts
Zero Gate Voltage Drain Current	V_{DS} = 28 V, V_{GS} = 0 V	I_{DSS}	—	—	1	mA
Gate Threshold Voltage	V_{DS} = 10 V, I_D = 75 mA	$V_{GS(th)}$	1	—	—	Volts
Forward Transconductance	V_{DS} = 10 V, I_D = 0.5 A	g_{fs}	1.0	—	—	Siemens

Maximum Ratings

Parameter	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	65	Vdc
Gate-Source Voltage	V_{GS}	±20	Vdc
Operating Junction Temperature	T_J	200	°C
Total Device Dissipation at Above 25°C derate by	P_D	237 1.35	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{CASE} = 70°C)	$R_{\theta JC}$	0.74	°C/W

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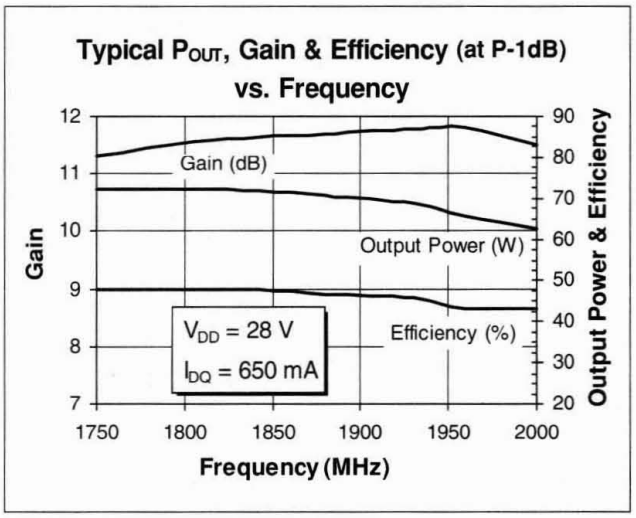
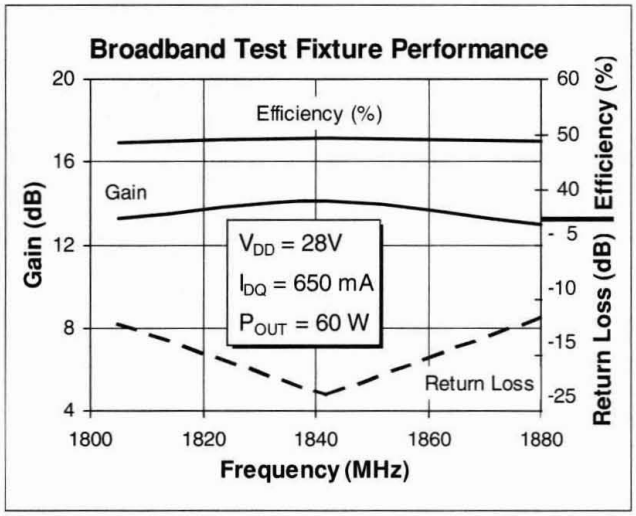
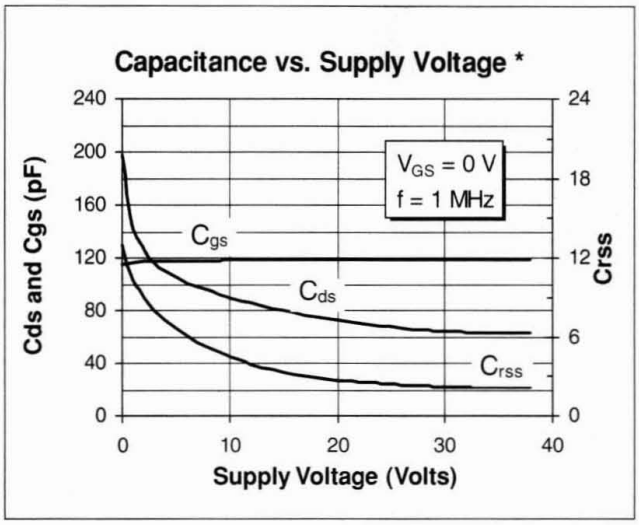
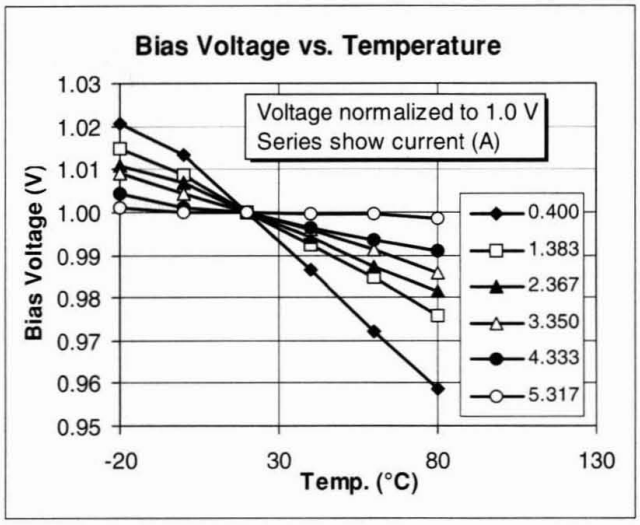
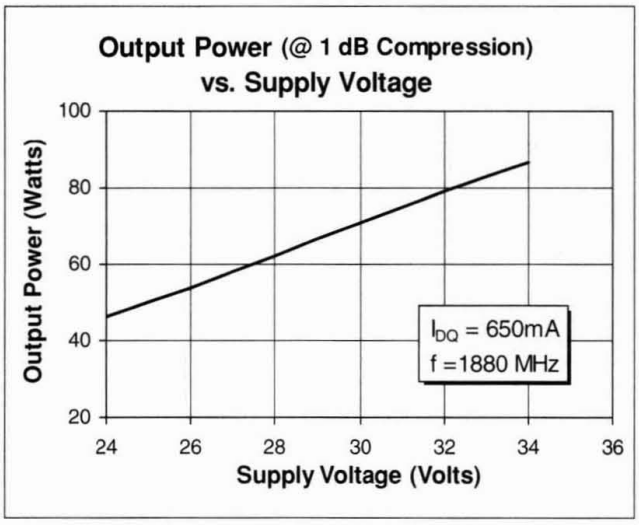
Typical Performance

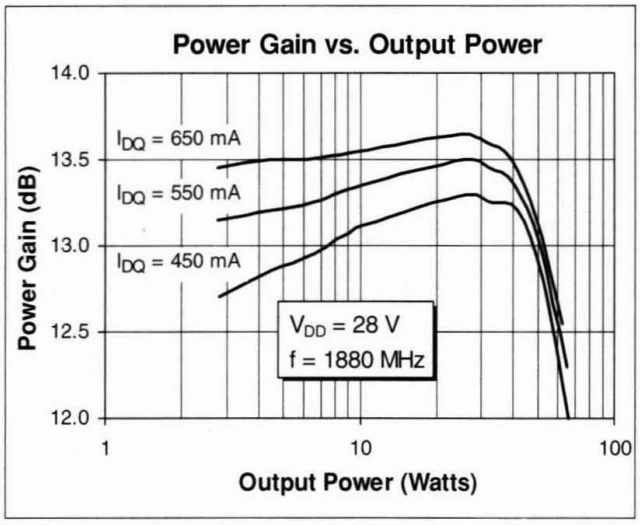








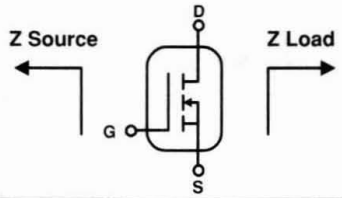




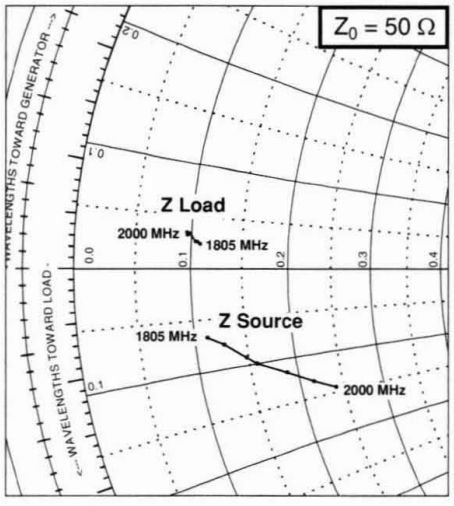
* This part is internally matched. Measurements of the finished product will not yield these results.

Impedance Data

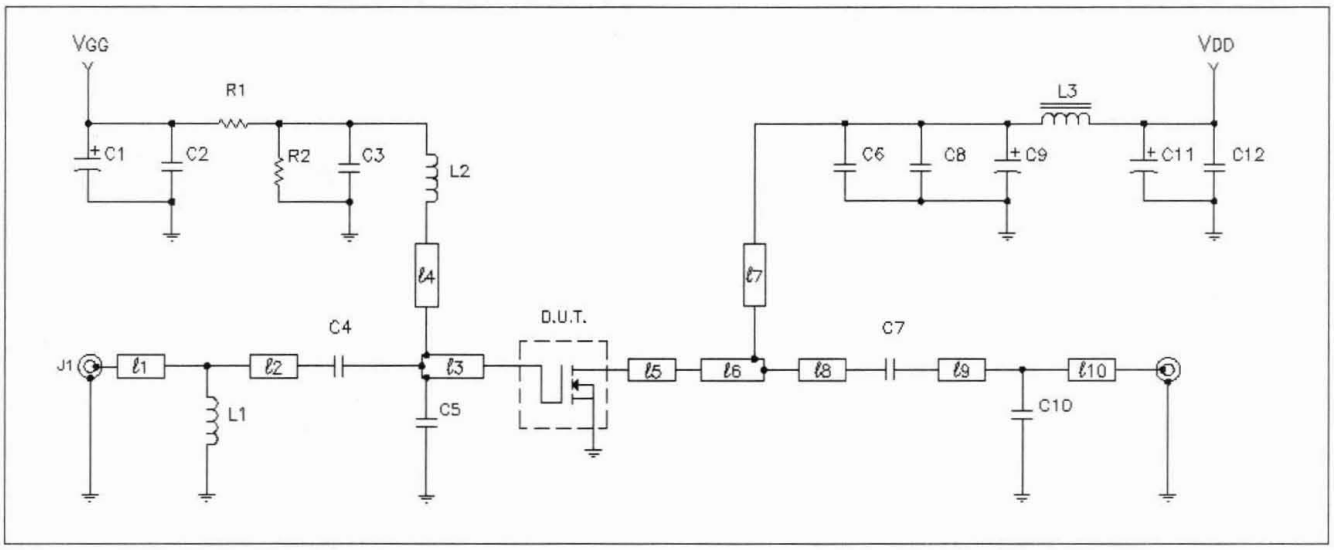
V_{DD} = 28 V, P_{OUT} = 60 W, I_{DQ} = 650 mA



Frequency	Z Source Ω		Z Load Ω	
MHz	R	jX	R	jX
1805	2.27	-3.40	2.12	1.20
1842	3.05	-3.86	1.97	1.31
1880	4.07	-4.04	1.88	1.31
1930	4.56	-5.10	1.59	1.68
1960	6.10	-5.90	1.46	1.74
1990	7.50	-6.75	1.48	1.61
2000	8.75	-7.40	1.53	1.64



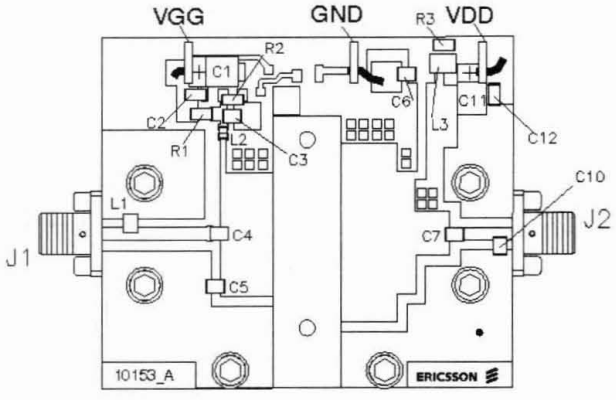
Test Circuit



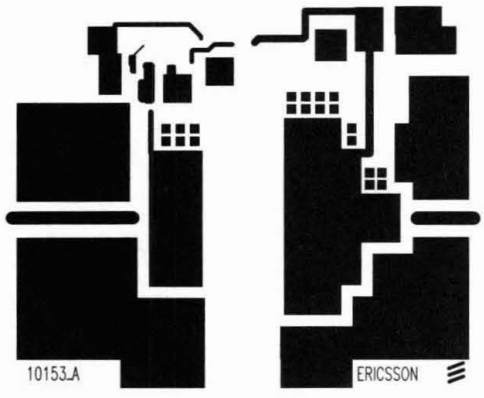
Block Diagram for f = 2 GHz

Q1	PTF 10153	NPN RF Transistor	
ℓ1	0.086 λ 2 GHz	Microstrip	50 Ω
ℓ2	0.132 λ 2 GHz	Microstrip	50 Ω
ℓ3	0.112 λ 2 GHz	Microstrip	9.24 Ω
ℓ4	0.064 λ 2 GHz	Microstrip	78 Ω
ℓ5	0.127 λ 2 GHz	Microstrip	6.64 Ω
ℓ6	0.041 λ 2 GHz	Microstrip	9.24 Ω
ℓ7	0.206 λ 2 GHz	Microstrip	65 Ω
ℓ8	0.077 λ 2 GHz	Microstrip	21.87 Ω
ℓ9	0.070 λ 2 GHz	Microstrip	50 Ω
ℓ10	0.028 λ 2 GHz	Microstrip	50 Ω

C1, C11	Capicitor, 10 µF	ATC 100 B
C2	Capicitor, 0.1 µF, 50 V	Digi-Key PCC103BCT
C3, C6, C4, C7	Capicitor, 10 pF	ATC 100 B
C5	Capicitor, 1.1 pF	ATC 100 B
C10	Capicitor, 0.30 pF	ATC 100 B
C12	Capicitor, 0.1 µF	ATC 100 B
R1, R2	Resistor, 220 Ω	Digi-Key 2.2QBK
R3	Resistor, 1.0 Ω	Digi-Key, # P1OCT
L1	Chip Inductor, 8 µH	Coilcraft A03T
L2	Chip Inductor, 2.7 µH	N/A
L3	Ferrite, 6 mm	N/A
PCB	0.050", ε_r = 6.0, 2 oz. Copper, TMM6, Rogers Corporation	



Assembly Diagram (not to scale)



Artwork (1 inch)

Ericsson Microelectronics
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Morgan Hill, CA 95037 USA
Assembly Diagram (not to scale)

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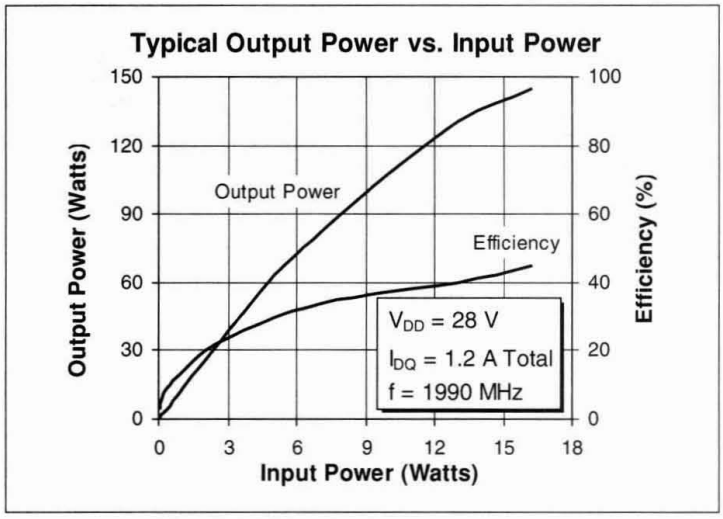
EUS/KR 1301-PTF 10153 Uen Rev. A 02-02-2000

PTF 10120
120 Watts, 1.8–2.0 GHz
GOLDMOS™ Field Effect Transistor

Description

The PTF 10120 is an internally matched common source N-channel enhancement-mode lateral MOSFET intended for CDMA and TDMA applications from 1.8 to 2.0 GHz. It is rated at 120 watts power output. Nitride surface passivation and full gold metallization ensure excellent device lifetime and reliability.

- ***INTERNALLY MATCHED***
- **Guaranteed Performance at 1.99 GHz, 28 V**
  - **Output Power = 120 Watts Min**
  - **Power Gain = 11 dB Typ**
- **Full Gold Metallization**
- **Silicon Nitride Passivated**
- **Back Side Common Source**
- **Excellent Thermal Stability**
- **100% Lot Traceability**



Package 20250

RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{DD} = 28 V, P_{OUT} = 30 W, I_{DQ} = 1.2 A Total, f = 1.99 GHz)	G_{ps}	10	11	—	dB
Power Output at 1 dB Compression (V_{DD} = 28 V, I_{DQ} = 1.2 A Total, f = 1.99 GHz)	P-1dB	120	—	—	Watts
Drain Efficiency (V_{DD} = 28 V, P_{OUT} = 120 W, I_{DQ} = 1.2 A Total, f = 1.99 GHz)	η_D	—	40	—	%
Load Mismatch Tolerance (V_{DD} = 28 V, P_{OUT} = 60 W, I_{DQ} = 1.2 A Total, f = 1.99 GHz —all phase angles at frequency of test)	Ψ	—	—	10:1	—

All published data at T_{CASE} = 25°C unless otherwise indicated.

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PTF 10120

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Electrical Characteristics (100% Tested—characteristics, conditions and limits shown per side)

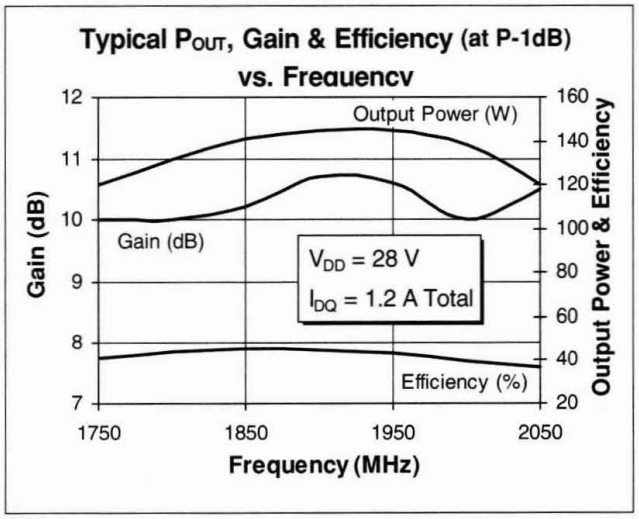
Characteristic (per side)	Conditions	Symbol	Min	Typ	Max	Units
Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 100 mA	$V_{(BR)DSS}$	65	—	—	Volts
Zero Gate Voltage Drain Current	V_{DS} = 28 V, V_{GS} = 0 V	I_{DSS}	—	—	5.0	mA
Gate Threshold Voltage	V_{DS} = 10 V, I_D = 150 mA	$V_{GS(th)}$	3.0	—	5.0	Volts
Forward Transconductance	V_{DS} = 10 V, I_D = 2 A	g_{fs}	—	4.0	—	Siemens

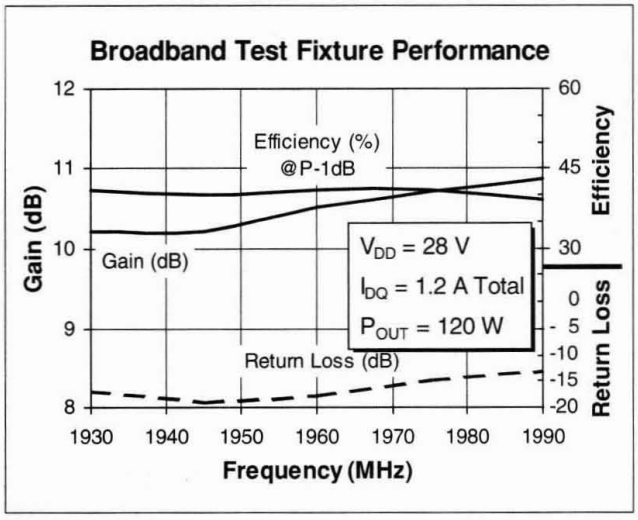
Maximum Ratings

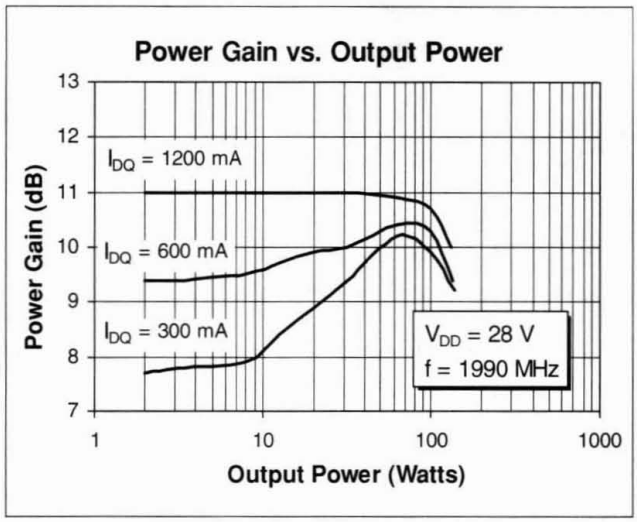
Parameter	Symbol	Value	Unit
Drain-Source Voltage(1)	V_{DSS}	65	Vdc
Gate-Source Voltage(1)	V_{GS}	±20	Vdc
Operating Junction Temperature	T_J	200	°C
Total Device Dissipation at Above 25°C derate by	P_D	440 2.51	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{CASE} = 70°C)	$R_{\theta JC}$	0.39	°C/W

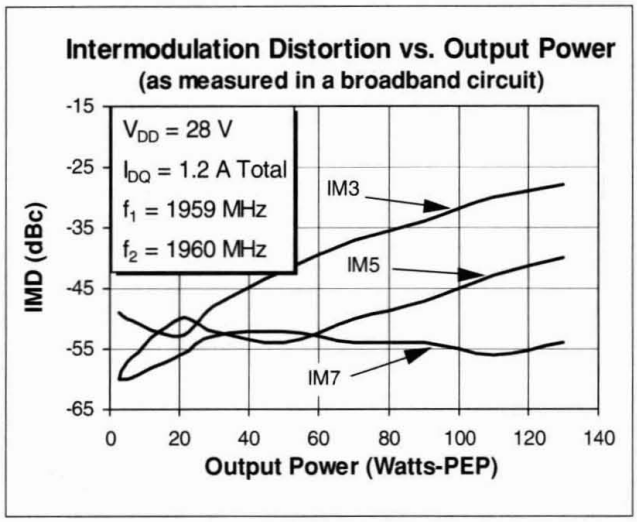
(1) per side

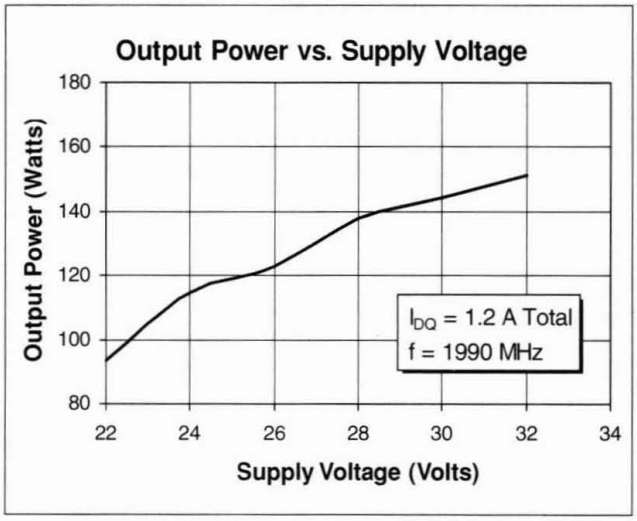
Typical Performance

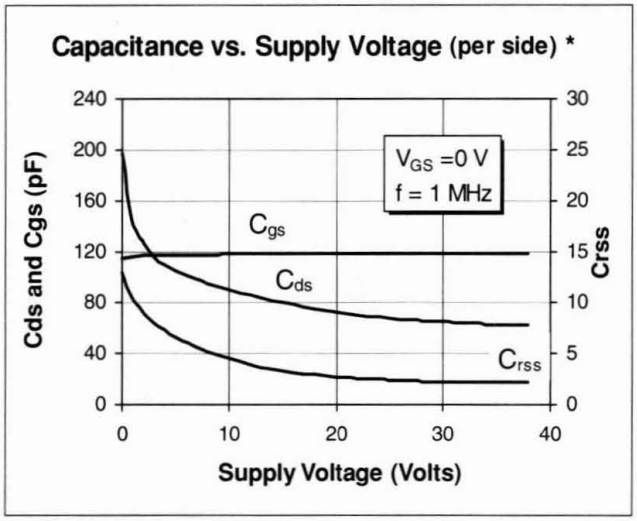








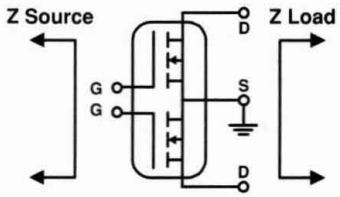


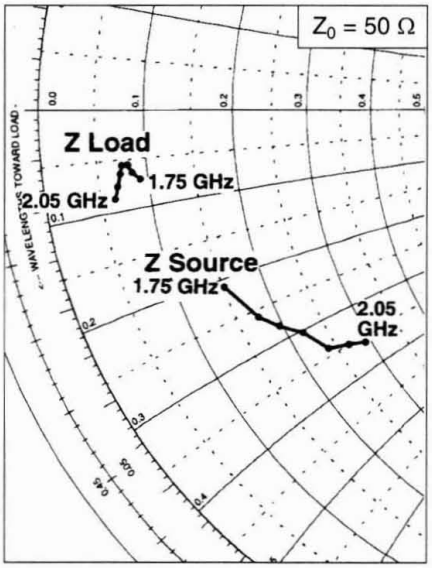


* This part is internally matched. Measurements of the finished product will not yield these results.

Impedance Data

(V_{DD} = 28 V, P_{OUT} = 120 W, I_{DQ} = 1.2 A Total)





Frequency	Z Source Ω		Z Load Ω	
GHz	R	jX	R	jX
1.75	7.6	-10.5	4.6	-3.6
1.80	8.8	-13.0	4.2	-3.2
1.85	9.8	-14.1	4.0	-2.8
1.90	11.0	-15.2	3.7	-2.8
1.95	12.0	-17.0	3.6	-3.2
2.00	13.4	-17.5	3.4	-3.8
2.05	14.6	-18.0	3.2	-4.4

PTF 10120

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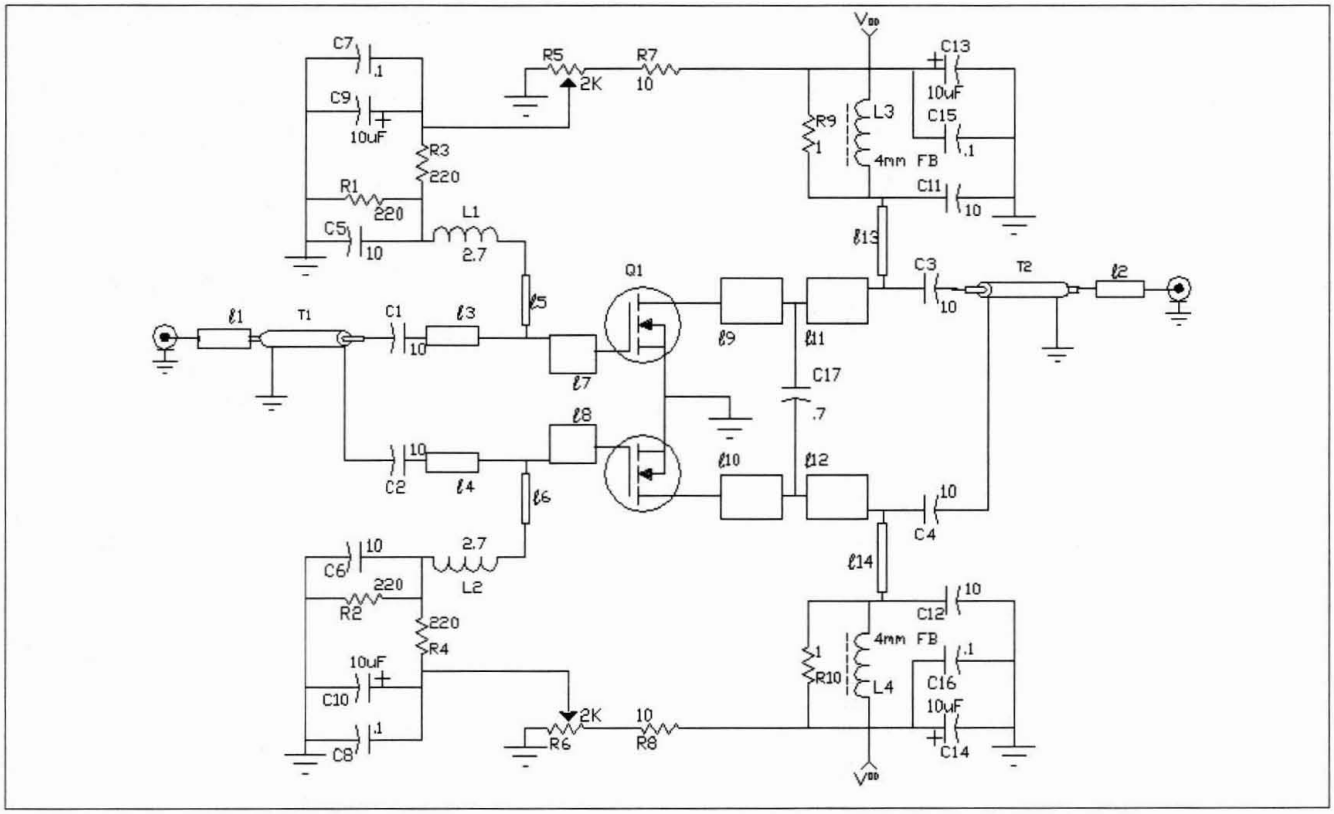
Test Circuit



Test Circuit Block Diagram for f = 2.0 GHz

Q1	PTF 10120	LDMOS RF Transistor
ℓ1, ℓ2		Microstrip 50 Ω
ℓ3, ℓ4	.048 λ @ 2.0 GHz	Microstrip 31.7 Ω
ℓ5, ℓ6	.18 λ @ 2.0 GHz	Microstrip 70 Ω
ℓ7, ℓ8	.097 λ @ 2.0 GHz	Microstrip 9.35 Ω
ℓ9, ℓ10	.129 λ @ 2 GHz	Microstrip 7.6 Ω
ℓ11, ℓ12	.031 λ @ 2 GHz	Microstrip 8.8 Ω
ℓ13, ℓ14	.25 λ @ 2 GHz	Microstrip 65 Ω
C1, C2, C3, C4, C5, C6, C11, C12	10 pF Chip Cap	ATC 100 B
C7, C8, C15, C16	0.1 μF Chip Cap	K1206
C9, C10, C13, C14	10 μF SMT Tantalum Cap	
C17	0.7 pF Chip Cap	ATC 100 B

L1, L2	2.7 nh	SMT Coil
L3, L4	4 mm	SMT Ferrite Bead
R1, R2, R3, R4	220 Ω	Chip Resistor K1206
R5, R6	2K	SMT Potentiometer
R7, R8	10 Ω	Chip Resistor K1206
R9, R10	1 Ω	Chip Resistor K1206
T1, T2	50 Ω Coaxial Balun	
Circuit Board	.028" Dielectric Thickness, ε_r = 4.0, AlliedSignal, G200, 2 oz. copper	

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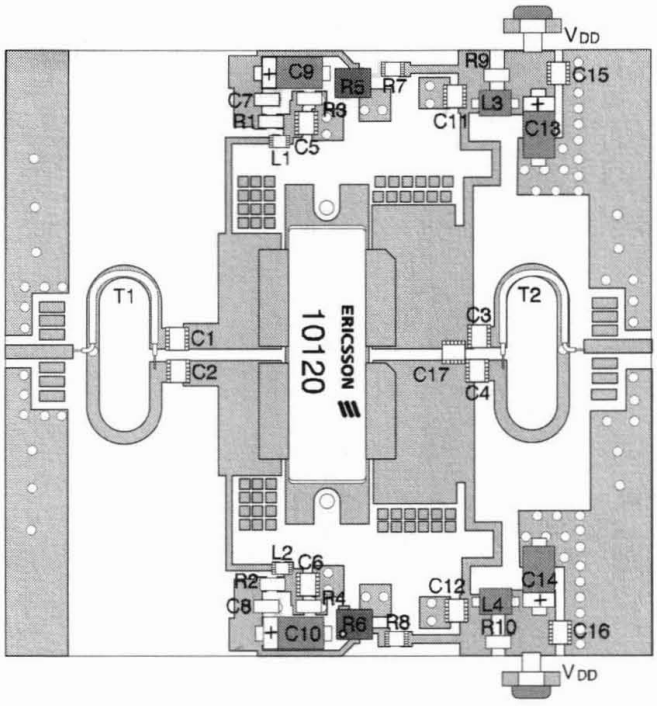
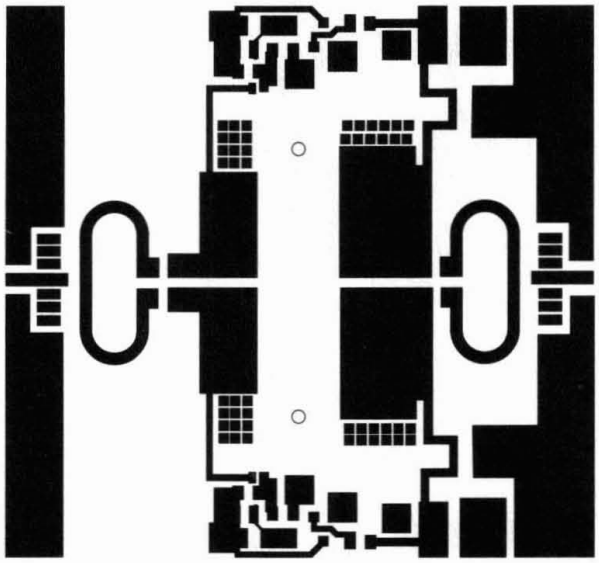
3



Parts Layout (not to scale)



Artwork (1 inch)

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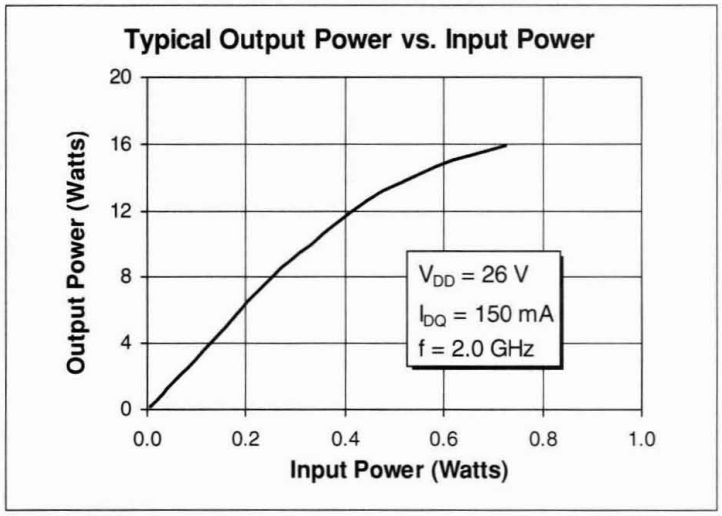
EUS/KR 1301-PTF 10120 Uen Rev. A 01-06-99

PTF 10043
12 Watts, 1.9–2.0 GHz
GOLDMOS™ Field Effect Transistor

Description

The PTF 10043 is an internally matched, common source, N-channel enhancement-mode lateral MOSFET intended for large signal amplifier applications in the 1.9 to 2.0 GHz range. It is rated at 12 watts power output. Nitride surface passivation and full gold metallization ensure excellent device reliability.

- ***INTERNALLY MATCHED***
- **Performance at 2.0 GHz, 26 Volts**
  - **Output Power = 12 Watts Min**
  - **Power Gain = 12 dB Typ at 3 Watts**
  - **Efficiency = 45% Typ**
- **Full Gold Metallization**
- **Silicon Nitride Passivated**
- **Back Side Common Source**
- **Excellent Thermal Stability**
- **100% Lot Traceability**



Package 20222

RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{DD} = 26 V, P_{OUT} = 3 W, I_{DQ} = 150 mA, f = 1.93, 2.0 GHz)	G_{ps}	11	12	—	dB
Power Output at 1 dB Compressed (V_{DD} = 26 V, P_{OUT} = 12 W, I_{DQ} = 150 mA, f = 2.0 GHz)	p-1dB	12	14	—	Watts
Drain Efficiency (V_{DD} = 26 V, P_{OUT} = 12 W, I_{DQ} = 150 mA, f = 2.0 GHz)	η_D	40	45	—	%
Load Mismatch Tolerance (V_{DD} = 26 V, P_{OUT} = 12 W, I_{DQ} = 150 mA, f = 2.0 GHz —all phase angles at frequency of test)	Ψ	—	—	10:1	—

All published data at T_{CASE} = 25°C unless otherwise indicated.

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PTF 10043

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Electrical Characteristics (100% Tested)

Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 5 mA	$V_{(BR)DSS}$	65	—	—	Volts
Zero Gate Voltage Drain Current	V_{DS} = 26 V, V_{GS} = 0 V	I_{DSS}	—	—	1.0	mA
Gate Threshold Voltage	V_{DS} = 10 V, I_D = 75 mA	$V_{GS(th)}$	3.0	—	5.0	Volts
Forward Transconductance	V_{DS} = 10 V, I_D = 2 A	g_{fs}	—	0.8	—	Siemens

Maximum Ratings

Parameter	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	65	Vdc
Gate-Source Voltage	V_{GS}	±20	Vdc
Operating Junction Temperature	T_J	200	°C
Total Device Dissipation Above 25°C derate by	P_D	55 0.31	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{CASE} = 70°C)	$R_{\theta JC}$	3.2	°C/W

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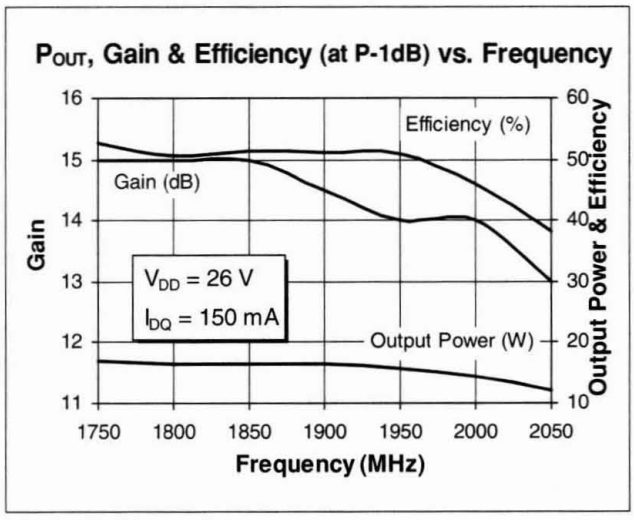
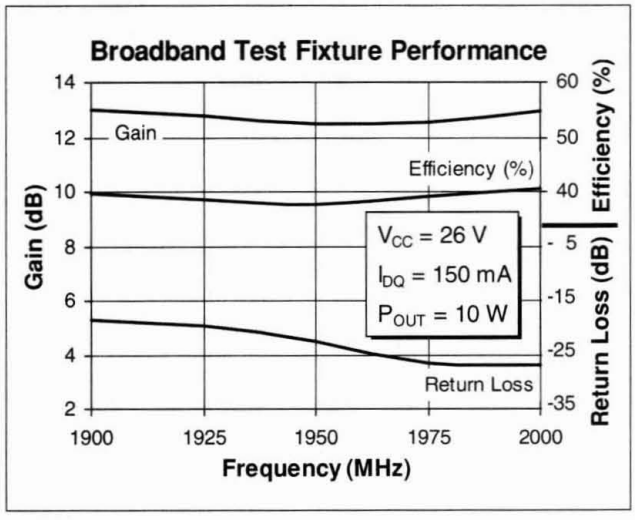
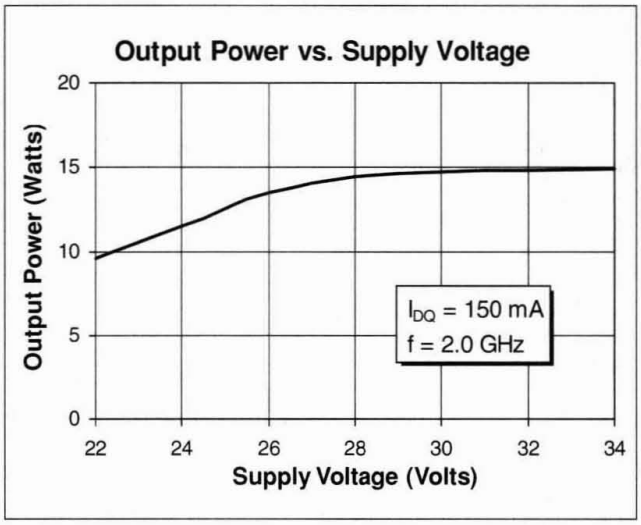
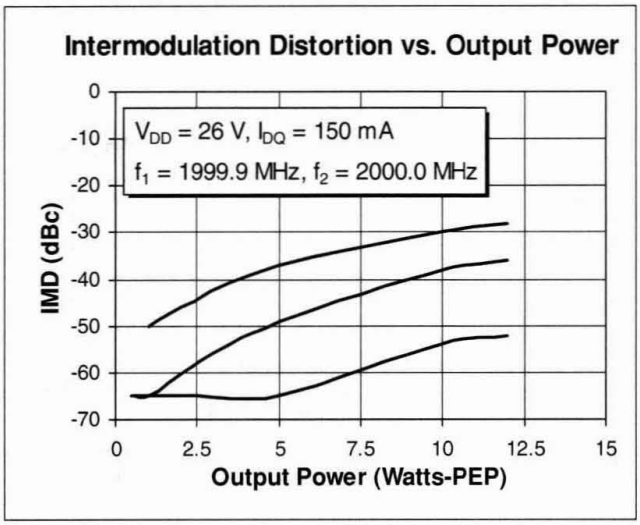
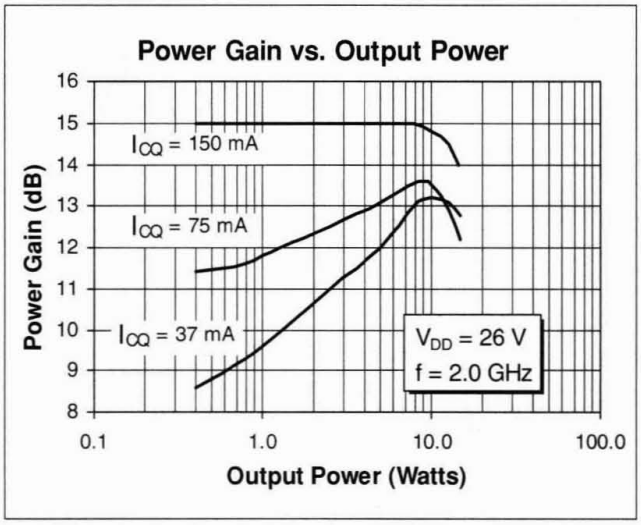
Typical Performance

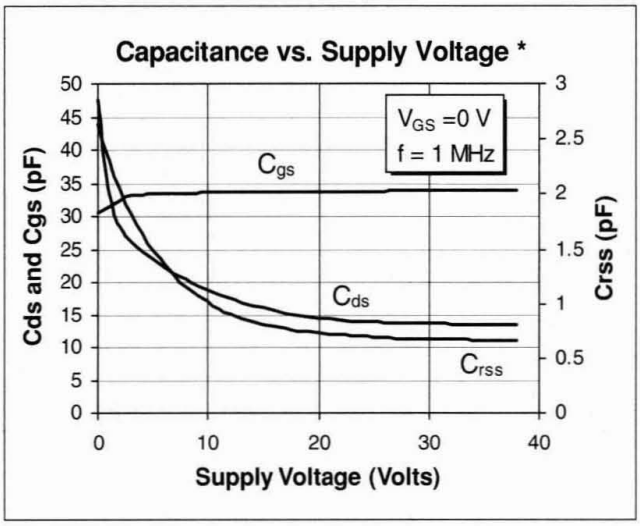




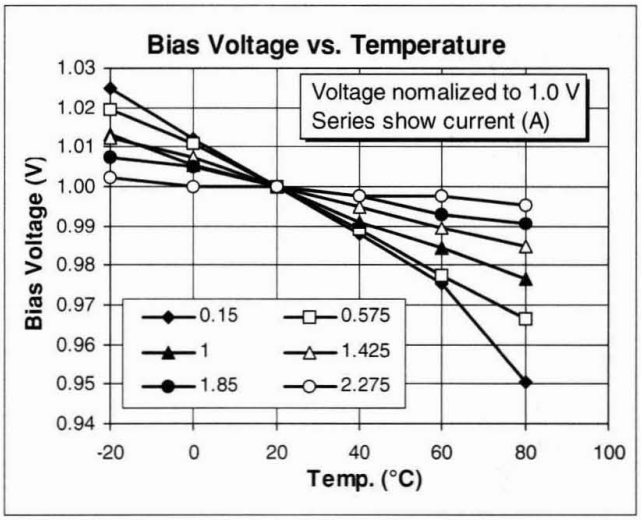






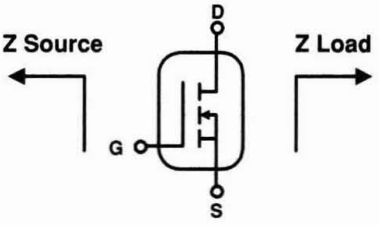


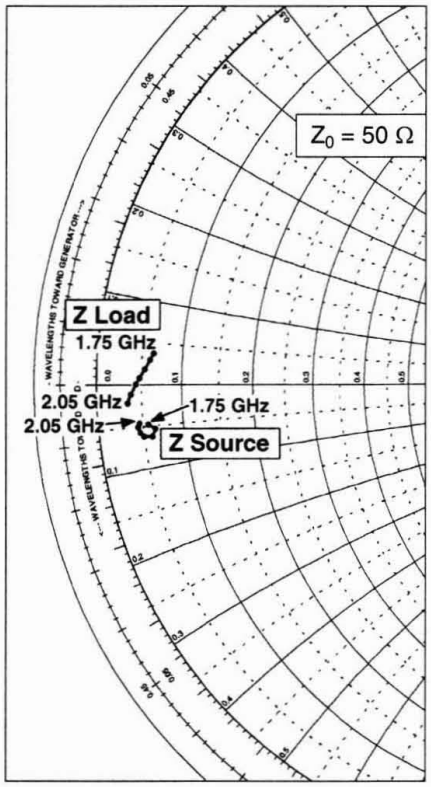
*This part is internally matched. Measurements of the finished product will not yield these figures.



Impedance Data

V_{DS} = 26 V, P_{OUT} = 12 W, I_{DQ} = 150 mA





Frequency	Z Source Ω		Z Load Ω	
GHz	R	jX	R	jX
1.75	2.8	-2.4	3.2	1.9
1.80	3.2	-2.7	3.0	1.5
1.85	3.0	-3.2	2.7	0.9
1.90	2.5	-3.1	2.4	0.4
1.95	2.3	-2.8	2.2	0.0
2.00	2.2	-2.5	1.9	-0.6
2.05	2.3	-2.3	1.7	-1.1

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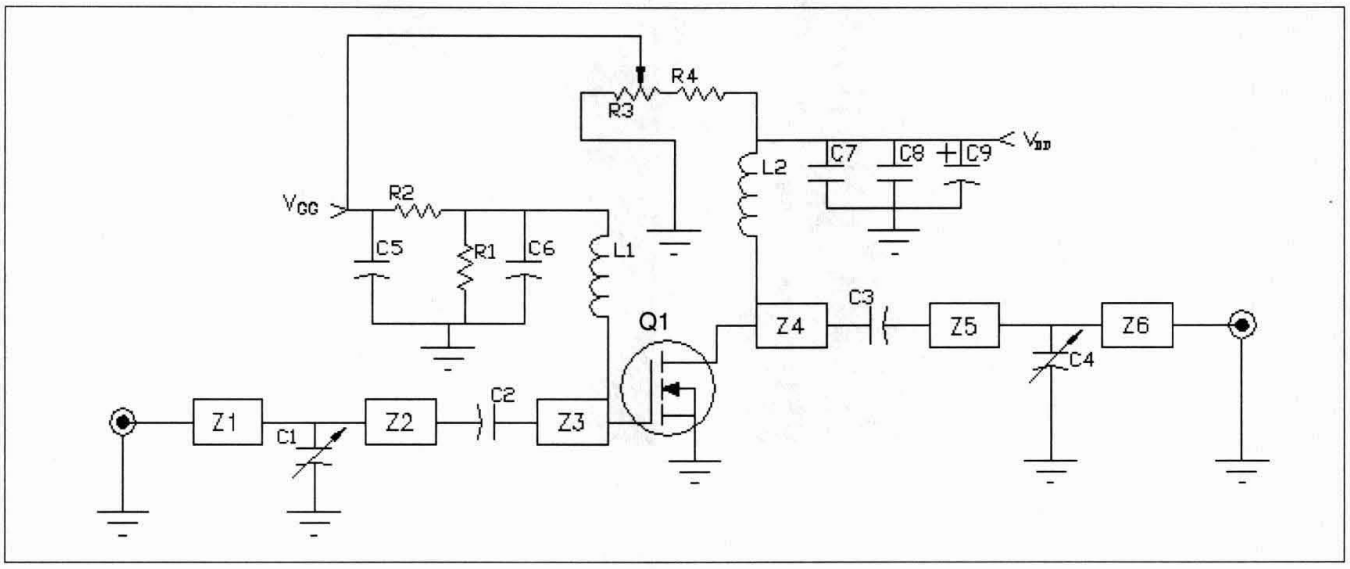
Typical Scattering Parameters

(V_{DS} = 28 V, I_D = 500 mA)

f	S11		S21		S12		S22	
(MHz)	Mag	Ang	Mag	Ang	Mag	Ang	Mag	Ang
100	0.912	-143	14.7	86	0.007	0	0.641	-70
200	0.917	-150	11.5	80	0.006	-5	0.650	-82
300	0.951	-163	5.83	53	0.004	-16	0.750	-107
400	0.964	-168	3.71	39	0.002	0	0.824	-122
500	0.971	-171	2.63	28	0.002	65	0.881	-132
600	0.974	-174	1.99	20	0.003	94	0.931	-139
700	0.975	-175	1.56	12	0.006	98	0.952	-146
800	0.975	-177	1.26	6	0.008	95	0.950	-151
900	0.980	-178	1.07	0	0.010	93	0.951	-155
1000	0.979	-179	0.932	-5	0.012	92	0.948	-158
1100	0.981	180	0.846	-11	0.014	89	0.959	-160
1200	0.977	179	0.790	-16	0.015	86	0.965	-162
1300	0.975	177	0.763	-23	0.017	83	0.970	-164
1400	0.965	176	0.759	-30	0.019	82	0.972	-166
1500	0.951	175	0.782	-39	0.021	80	0.974	-168
1600	0.929	174	0.828	-51	0.023	78	0.975	-169
1700	0.904	174	0.880	-68	0.025	74	0.986	-170
1800	0.885	175	0.884	-89	0.027	70	1.00	-171
1900	0.892	177	0.802	-113	0.029	67	1.02	-173
2000	0.918	177	0.650	-134	0.030	61	1.02	-175
2100	0.942	177	0.489	-151	0.028	54	1.01	-177
2200	0.964	176	0.366	-162	0.025	56	1.01	-178

Test Circuit

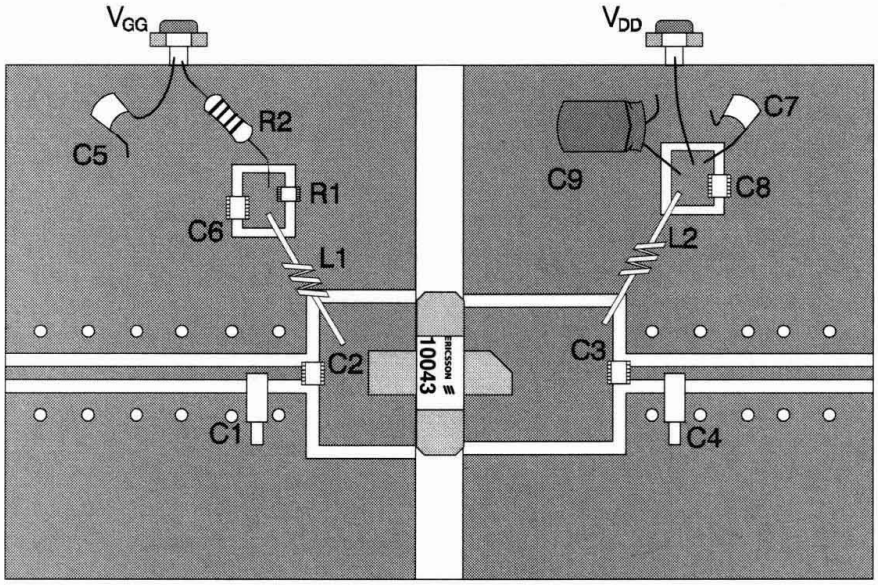


Block Diagram for f = 2.0 GHz

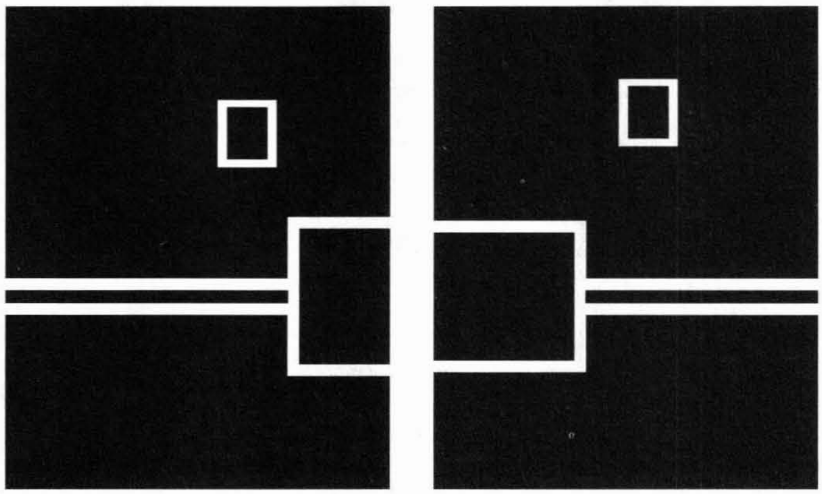
Q1	PTF 10043	RF LDMOS FET
Z1, Z6	50 Ω	Microstrip
Z2, Z5	50 Ω, 0.085 λ	Microstrip
Z3	7.5 Ω, 0.154 λ	Microstrip
Z4	7.9 Ω, 0.238 λ	Microstrip
C1, C4	0.3–3.5	Trim Capacitor
C2, C3, C6, C8	33 pF	Capacitor ATCB
C5, C7	0.1 μF, 50 V	Capacitor Digi-Key P4917-ND
C9	100 μF, 50V	Electrolytic Capacitor Digi-Key P5276
L1, L2	#20 AWG	3 Turn, 0.12" I.D.
R1, R2	500 Ω	Resistor
Circuit Board	.028" Dielectric Thickness, ε_r = 4.0, AlliedSignal, G200, 2 oz. copper	

Bias Parts (not shown on layout)

R3	2 K	Potentiometer
R4	10 Ω	Resistor



Parts Layout (not to scale)



Artwork (1 inch ———)

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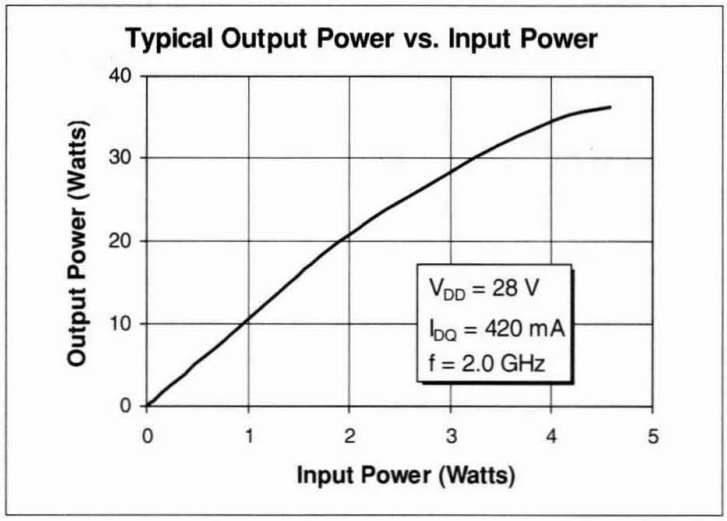
EUS/KR 1301-PTF 10043 Uen Rev. A 03-19-99

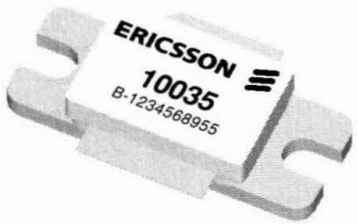
PTF 10035
30 Watts, 1.9–2.0 GHz
GOLDMOS™ Field Effect Transistor

Description

The PTF 10035 is an internally matched common source N-channel enhancement-mode lateral MOSFET intended for large signal amplifier applications from 1.9 to 2.0 GHz. It is rated at 30 watts power output. Nitride surface passivation and full gold metallization ensure excellent device lifetime and reliability.

- ***INTERNALLY MATCHED***
- **Guaranteed Performance at 2.0 GHz, 28 V**
  - **Output Power = 30 Watts Min**
  - **Gain = 12.5 dB Typ**
- **Full Gold Metallization**
- **Silicon Nitride Passivated**
- **Excellent Thermal Stability**
- **100% Lot Traceability**





Package 20237

RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{DD} = 28 V, P_{OUT} = 10 W, I_{DQ} = 420 mA, f = 2.0 GHz)	G_{ps}	11	12.5	—	dB
Power Output at 1 dB Compression (V_{DD} = 28 V, I_{DQ} = 420 mA, f = 2.0 GHz)	P-1dB	30	35	—	Watts
Drain Efficiency (V_{DD} = 28 V, P_{OUT} = 30 W, I_{DQ} = 420 mA, f = 2.0 GHz)	η	35	40	—	%
Load Mismatch Tolerance (V_{DD} = 28 V, P_{OUT} = 30 W, I_{DQ} = 420 mA, f = 2.0 GHz —all phase angles at frequency of test)	Ψ	—	—	10:1	—

All published data at T_{CASE} = 25°C unless otherwise indicated.

ERICSSON

PTF 10035

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Electrical Characteristics (100% Tested)

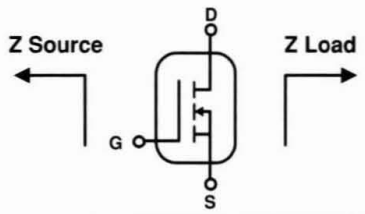
Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 100 mA	$V_{(BR)DSS}$	65	65	—	Volts
Zero Gate Voltage Drain Current	V_{DS} = 28 V, V_{GS} = 0 V	I_{DSS}	—	—	1.0	mA
Gate Threshold Voltage	V_{DS} = 10 V, I_D = 75 mA	$V_{GS(th)}$	3.0	—	5.0	Volts
Forward Transconductance	V_{DS} = 10 V, I_D = 6 A	g_{fs}	—	1.8	—	Siemens

Maximum Ratings

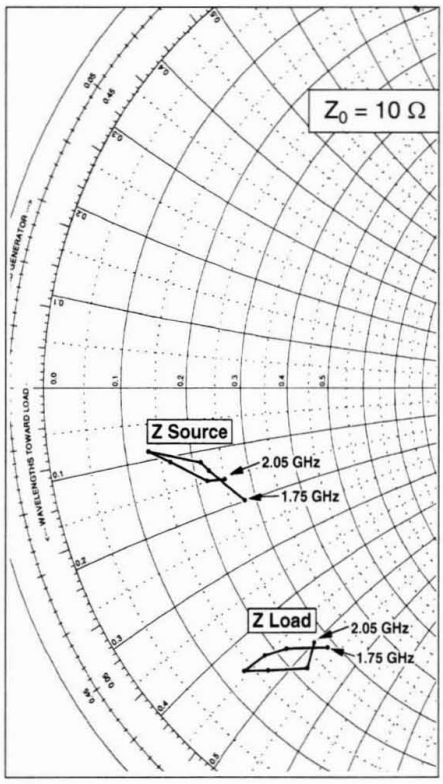
Parameter	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	65	Vdc
Gate-Source Voltage	V_{GS}	±20	Vdc
Operating Junction Temperature	T_J	200	°C
Total Device Dissipation Above 25°C derate by	P_D	120 0.7	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{CASE} = 70°C)	$R_{\theta JC}$	1.4	°C/W

Impedance Data

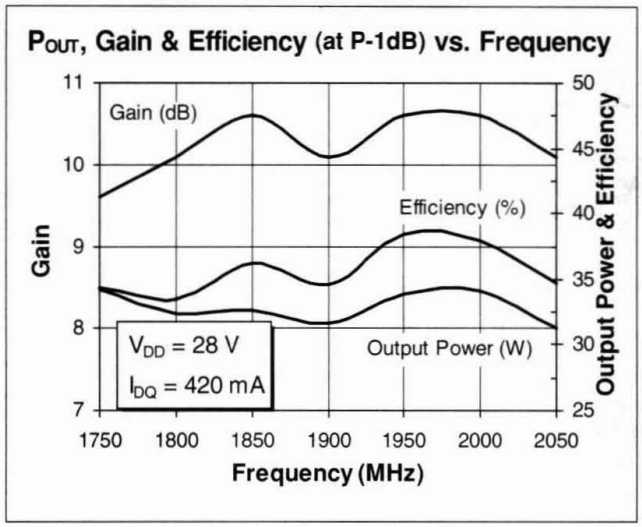
(V_{DD} = 28 V, P_{OUT} = 30 W, I_{DQ} = 420 mA)

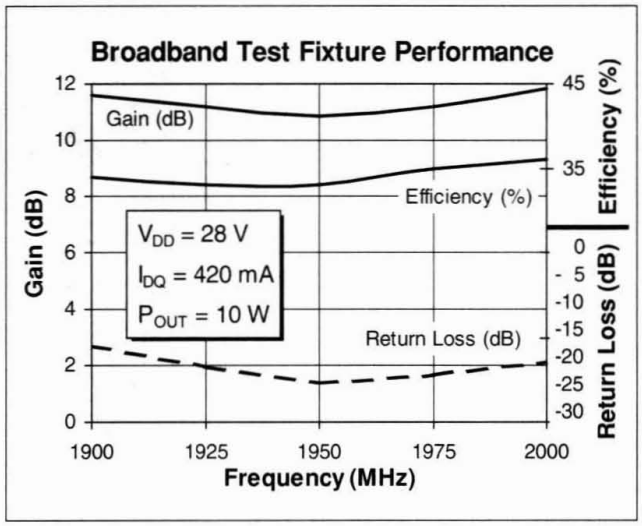


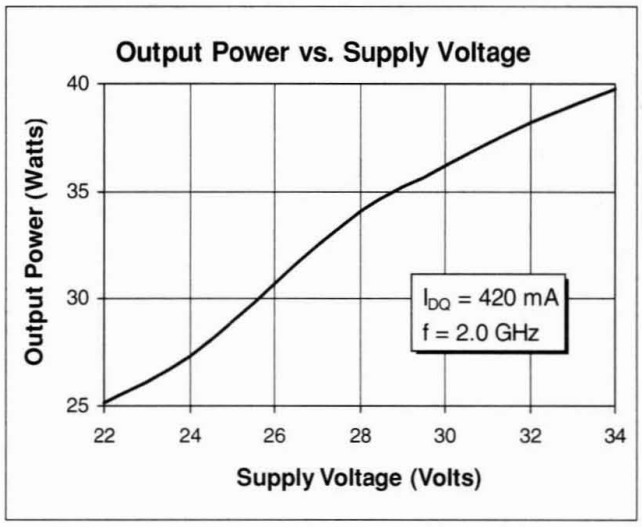
Frequency	Z Source Ω		Z Load Ω	
GHz	R	jX	R	jX
1.75	2.78	-1.99	2.84	-5.27
1.80	2.25	-1.34	2.19	-4.69
1.85	2.14	-1.18	1.80	-4.50
1.90	1.33	-0.88	1.36	-4.43
1.95	1.64	-1.08	1.68	-4.72
2.00	2.19	-1.49	2.25	-5.24
2.05	2.51	-1.54	2.70	-5.00

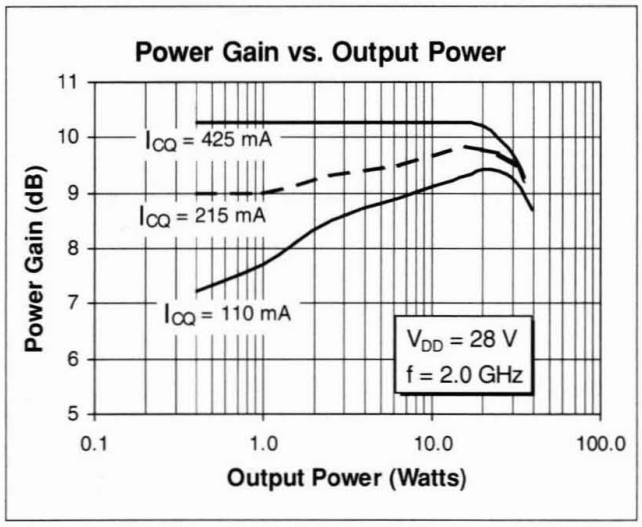


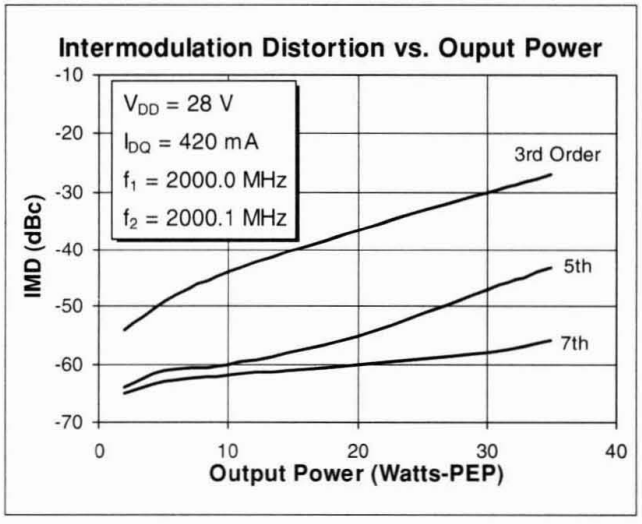
Typical Performance

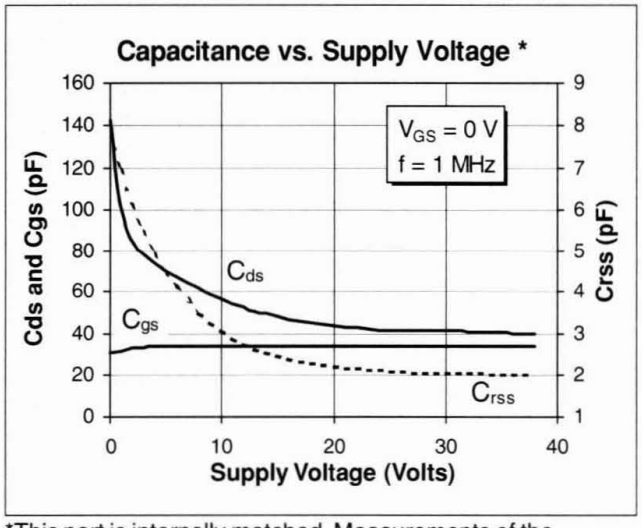




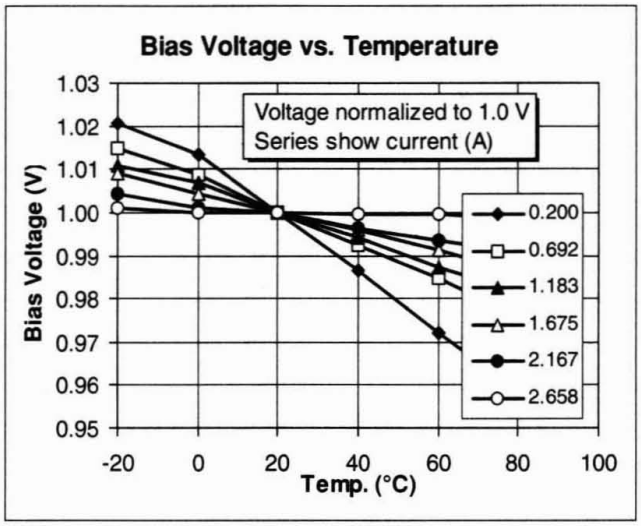








*This part is internally matched. Measurements of the finished product will not yield these figures.

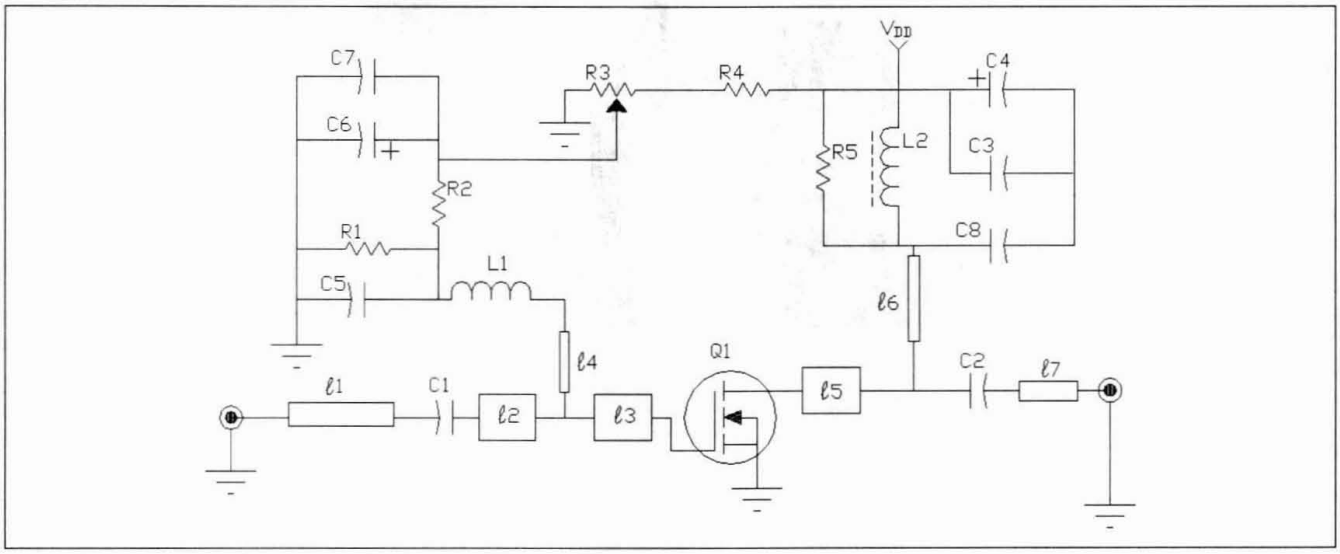


Typical Scattering Parameters

(V_{DS} = 28 V, I_D = 1.0 A)

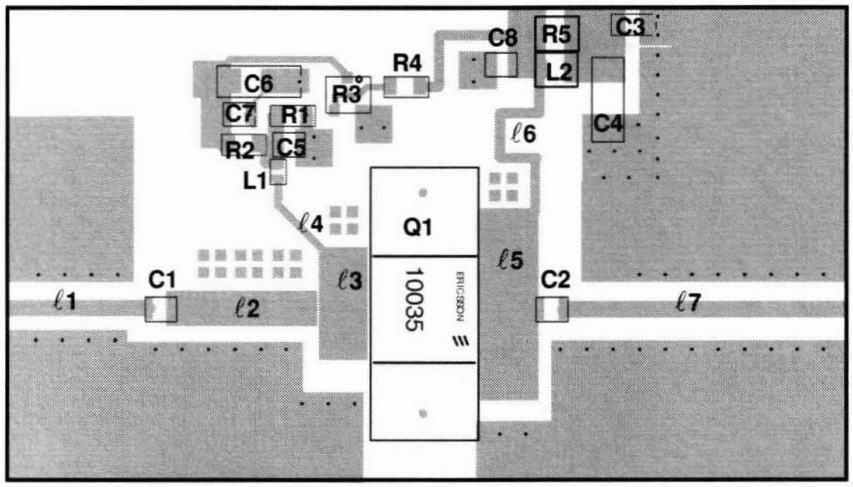
f	S11		S21		S12		S22	
(MHz)	Mag	Ang	Mag	Ang	Mag	Ang	Mag	Ang
100	0.934	-159	4.19	36	0.001	78	0.765	-158
200	0.947	-163	2.97	32	0.002	90	0.795	-164
300	0.979	-172	0.814	13	0.004	95	0.870	-170
400	0.983	-176	0.380	6	0.006	94	0.914	-174
500	0.982	-179	0.202	3	0.008	92	0.929	-177
600	0.980	179	0.102	7	0.011	88	0.978	-179
700	0.980	177	0.038	38	0.013	84	1.00	175
800	0.982	176	0.046	119	0.015	81	0.933	170
900	0.987	174	0.092	135	0.018	79	0.890	169
1000	0.987	172	0.145	137	0.021	75	0.847	168
1100	0.989	171	0.212	136	0.024	69	0.846	169
1200	0.990	169	0.321	136	0.025	65	0.849	167
1300	0.998	166	0.537	130	0.028	63	0.837	164
1400	1.00	162	0.970	114	0.034	58	0.794	159
1500	0.952	157	1.72	80	0.040	41	0.623	154
1600	0.838	154	2.20	37	0.036	20	0.476	170
1700	0.749	157	2.40	-5	0.024	7	0.605	-174
1800	0.720	160	2.13	-43	0.016	27	0.804	-177
1900	0.668	162	1.86	-73	0.020	41	0.871	177
2000	0.643	170	1.63	-103	0.021	39	0.889	172
2100	0.717	177	1.33	-132	0.019	44	0.881	169
2200	0.838	178	1.00	-158	0.021	60	0.883	167

Test Circuit

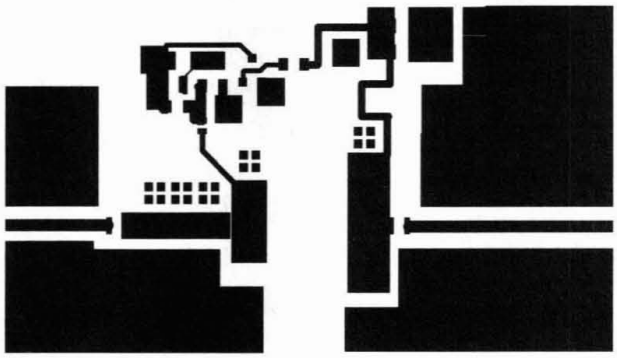


Test Circuit Block Diagram for f = 2.0 GHz

Q1	10035	LDMOS RF Transistor	L1	2.7 nH	SMT Coil
ℓ1, ℓ7		Microstrip 50 Ω	L2	4mm SMT Ferrite Bead	
ℓ2	.1784 λ @ 2.0 GHz	Microstrip 29.18 Ω	R1, R2	220 Ω Chip Resistor	K1206
ℓ3	.0612 λ @ 2.0 GHz	Microstrip 16.63 Ω	R3	2K SMT Potentiometer	
ℓ4	.08 λ @ 2.0 GHz	Microstrip 70 Ω	R4	10 Ω Chip Resistor	K1206
ℓ5	.0752 λ @ 2.0 GHz	Microstrip 7.23 Ω	R5	1 Ω Chip Resistor	K1206
ℓ6	.224 λ @ 2.0 GHz	Microstrip 65 Ω	Circuit Board	.028" Dielectric Thickness, ε_r = 4.0, AlliedSignal, G200, 2 oz. copper	
C1, C2, C5, C8	33 pF Chip Cap	ATC 100 B			
C3, C7	0.1 μF Chip Cap	C4, C6 10 μF SMT Tantalum			



Assembly Diagram (not to scale)



Artwork (approx. 1 inch)

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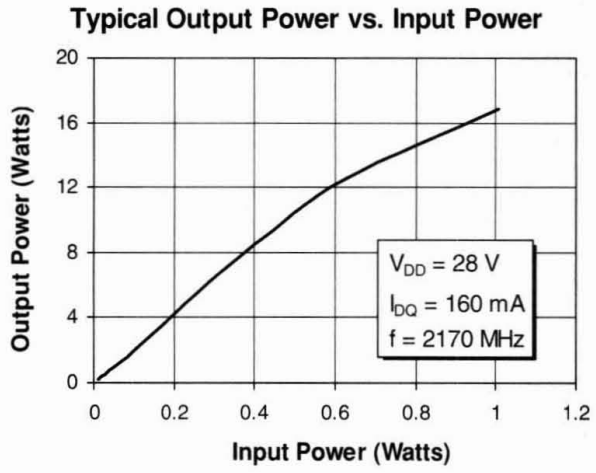
PTF 10119
12 Watts, 2.1–2.2 GHz
GOLDMOS™ Field Effect Transistor

Description

The PTF 10119 is an internally matched, common source, N-channel enhancement-mode lateral MOSFET intended for WCDMA applications from 2.1 to 2.2 GHz. It is rated at 12 watts power output. Nitride surface passivation and gold metallization ensure excellent device reliability.

- ***INTERNALLY MATCHED***
- **Performance at 2.17 GHz, 28 Volts**
  - **Output Power = 12 Watts Min**
  - **Power Gain = 11 dB Typ**
  - **Efficiency = 43% Typ @ P-1dB**
- **Full Gold Metallization**
- **Silicon Nitride Passivated**
- **Back Side Common Source**
- **Excellent Thermal Stability**
- **100% lot traceability**



Package 20222

Maximum Ratings

Parameter	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	65	Vdc
Gate-Source Voltage	V_{GS}	±20	Vdc
Operating Junction Temperature	T_J	200	°C
Total Device Dissipation at T_{flange} = 25°C Above 25°C derate by	P_D	55 0.31	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{flange} = 70°C)	$R_{\theta JC}$	3.2	°C/W

ERICSSON

PTF 10119

ERICSSON

Electrical Characteristics (100% Tested)

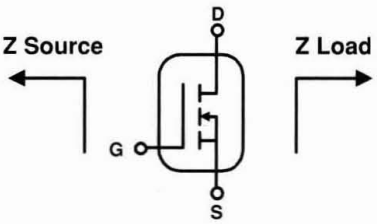
Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 50 mA	$V_{(BR)DSS}$	65	—	—	Volts
Zero Gate Voltage Drain Current	V_{DS} = 26 V, V_{GS} = 0 V	I_{DSS}	—	—	1.0	mA
Gate Threshold Voltage	V_{DS} = 10 V, I_D = 75 mA	$V_{GS(th)}$	3.0	—	5.0	Volts
Forward Transconductance	V_{DS} = 10 V, I_D = 2 A	g_{fs}	—	0.8	—	Siemens

RF Specifications (100% Tested)

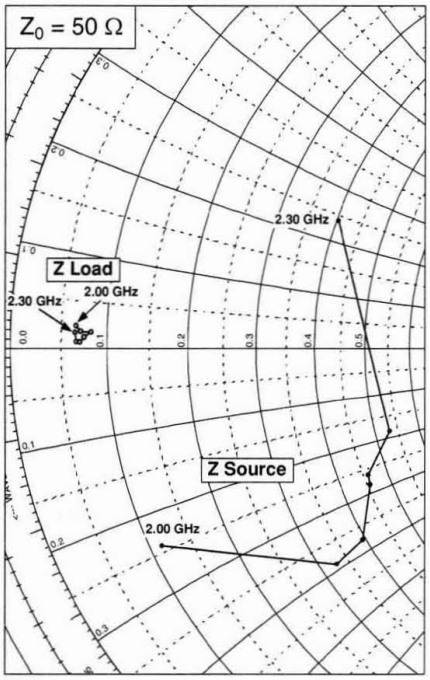
Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{DD} = 28 V, P_{OUT} = 3 W, I_{DQ} = 160 mA, f = 2.11, 2.17 GHz)	G_{ps}	10	11	—	dB
Power Output at 1 dB Compressed (V_{DD} = 28 V, I_{DQ} = 160 mA, f = 2.17 GHz)	p-1dB	12	14	—	Watts
Drain Efficiency (V_{DD} = 28 V, P_{OUT} = 12 W, I_{DQ} = 160 mA, f = 2.17 GHz)	η_D	30	43	—	%
Load Mismatch Tolerance (V_{DD} = 28 V, P_{OUT} = 12 W, I_{DQ} = 160 mA, f = 2.17 GHz —all phase angles at frequency of test)	Ψ	—	—	10:1	—

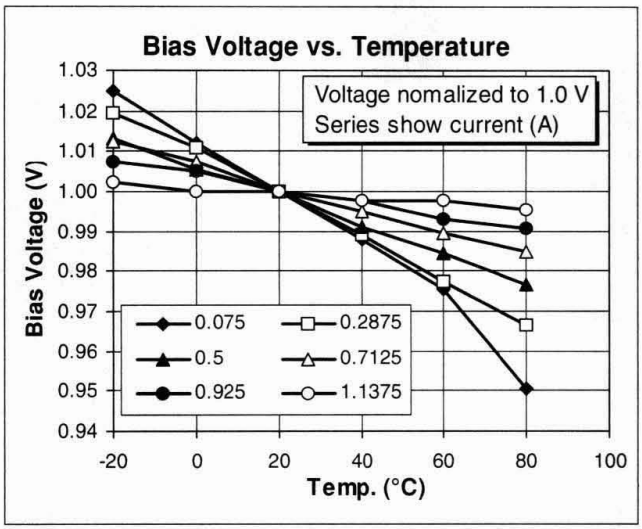
Impedance Data

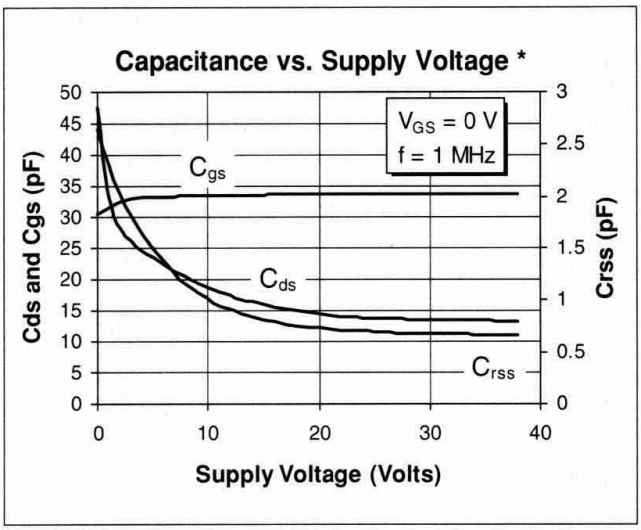
V_{DS} = 28 V, P_{OUT} = 12 W, I_{DQ} = 160 mA



Frequency	Z Source Ω		Z Load Ω	
GHz	R	jX	R	jX
2.00	5.7	-12.11	3.30	1.21
2.10	16.4	-19.50	3.55	0.92
2.12	19.7	-18.82	4.12	0.88
2.15	22.8	-14.14	3.75	0.62
2.17	23.0	-13.15	3.53	0.34
2.20	26.6	-9.28	3.32	0.38
2.30	20.2	12.03	3.23	0.84







*This part is internally matched. Measurements of the finished product will not yield these figures.

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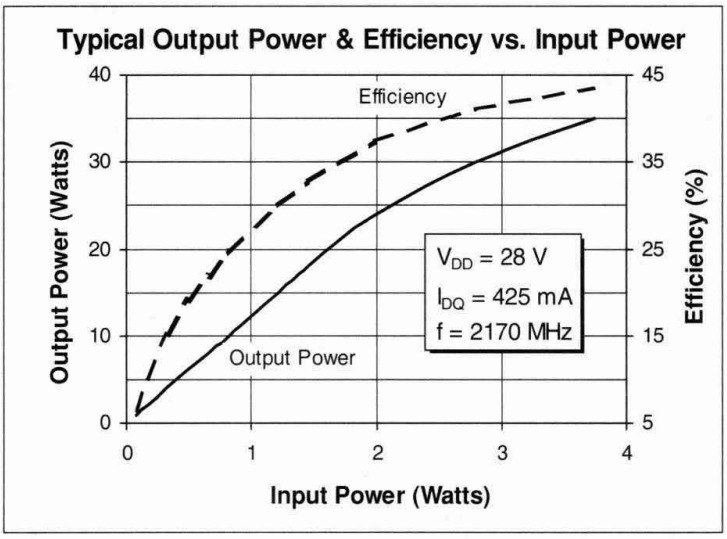
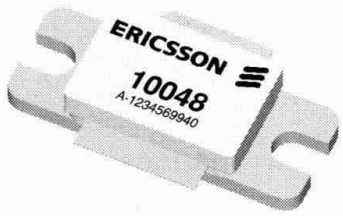
PTF 10048
30 Watts, 2.1–2.2 GHz, W-CDMA
GOLDMOS™ Field Effect Transistor

Description

The PTF 10048 is an internally matched common source N-channel enhancement-mode lateral MOSFET specifically intended for W-CDMA applications as well as other large signal amplifier applications from 2.1 to 2.2 GHz. This power transister is rated at 30 watts minimum power output. Nitride surface passivation and gold metallization ensure excellent device lifetime and reliability.

- ***INTERNALLY MATCHED***
- **Guaranteed Performance at 2.17 GHz, 28 V**
  - **Output Power = 30 Watts Min**
  - **Gain = 10.5 dB Typ at 30 Watts**
- **Full Gold Metallization**
- **Silicon Nitride Passivated**
- **Excellent Thermal Stability**
- **100% Lot Traceability**





Package 20237

RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{DD} = 28 V, P_{OUT} = 10 W, I_{DQ} = 425 mA, f = 2.11 & 2.17 GHz)	G_{ps}	10	11	—	dB
Power Output at 1 dB Compression (V_{DD} = 28 V, I_{DQ} = 425 mA, f = 2.17 GHz)	P-1dB	30	36	—	Watts
Drain Efficiency (V_{DD} = 28 V, P_{OUT} = 30 W, I_{DQ} = 425 mA, f = 2.17 GHz)	η	30	40	—	%
Load Mismatch Tolerance (V_{DD} = 28 V, P_{OUT} = 30 W, I_{DQ} = 425 mA, f = 2.17 GHz —all phase angles at frequency of test)	Ψ	—	—	10:1	—

All published data at T_{CASE} = 25°C unless otherwise indicated.

PTF 10048

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Electrical Characteristics (100% Tested)

Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 50 mA	$V_{(BR)DSS}$	65	65	—	Volts
Zero Gate Voltage Drain Current	V_{DS} = 28 V, V_{GS} = 0 V	I_{DSS}	—	—	1.0	mA
Gate Threshold Voltage	V_{DS} = 10 V, I_D = 75 mA	$V_{GS(th)}$	3.0	—	5.0	Volts
Forward Transconductance	V_{DS} = 10 V, I_D = 6 A	g_{fs}	—	1.8	—	Siemens

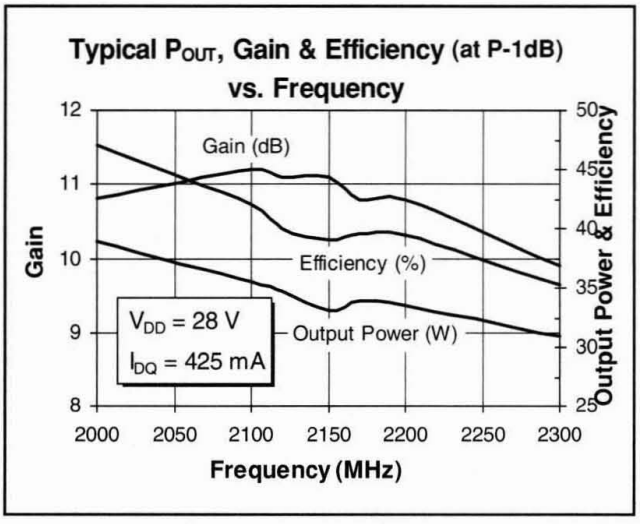
Maximum Ratings

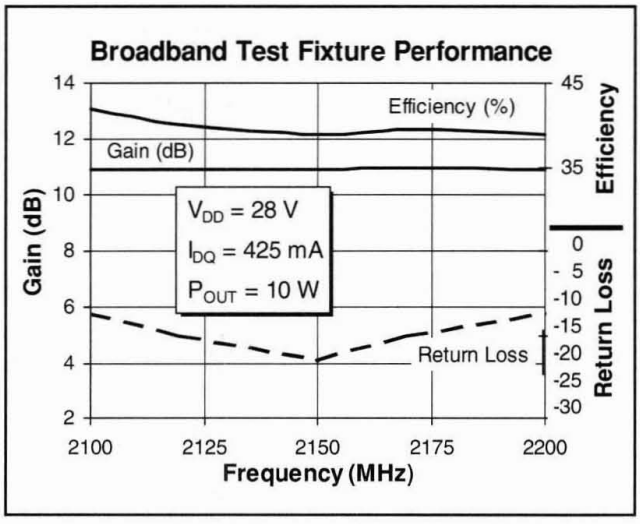
Parameter	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	65	Vdc
Gate-Source Voltage	V_{GS}	±20	Vdc
Operating Junction Temperature	T_J	200	°C
Total Device Dissipation Above 25°C derate by	P_D	120 0.66	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{CASE} = 70°C)	$R_{\theta JC}$	1.5	°C/W

GOLDMOS™

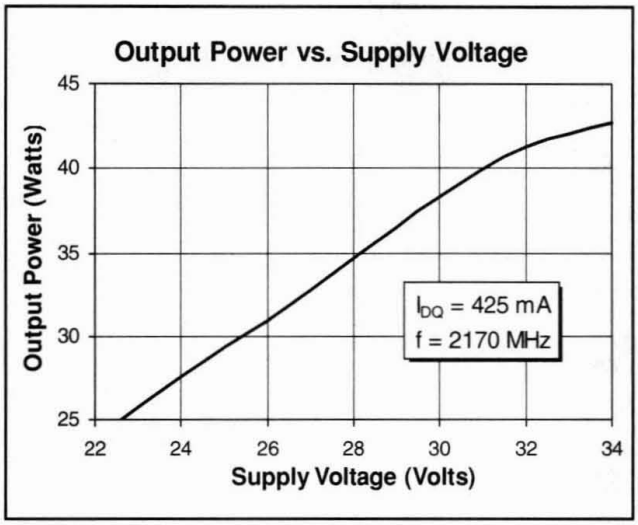
3

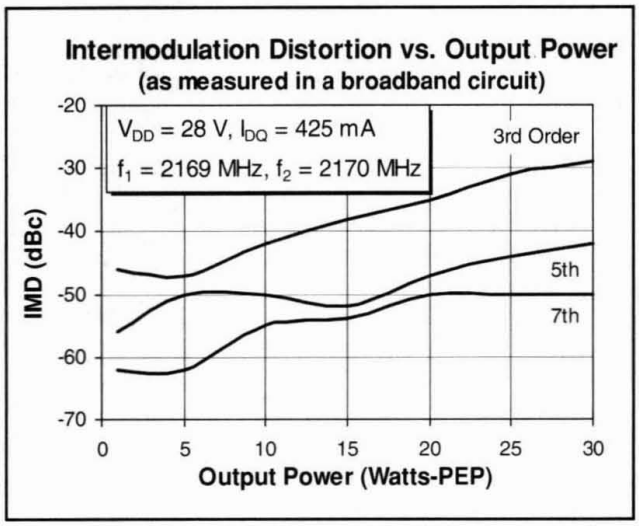
Typical Performance

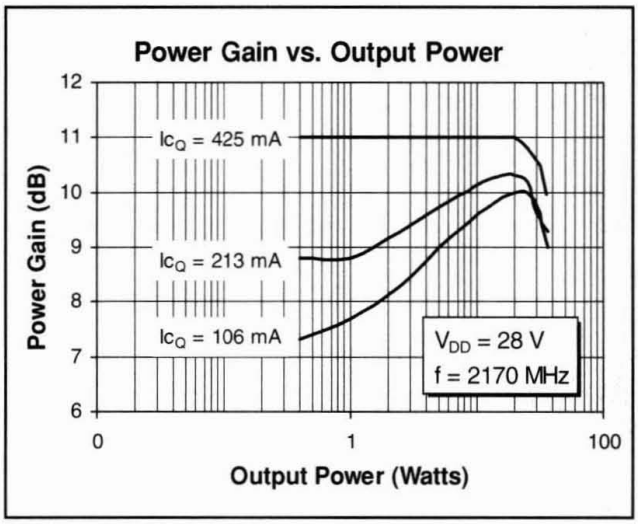


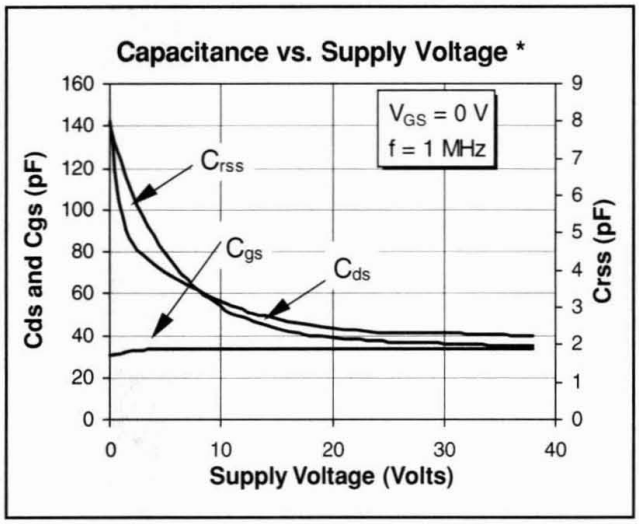


Typical Performance

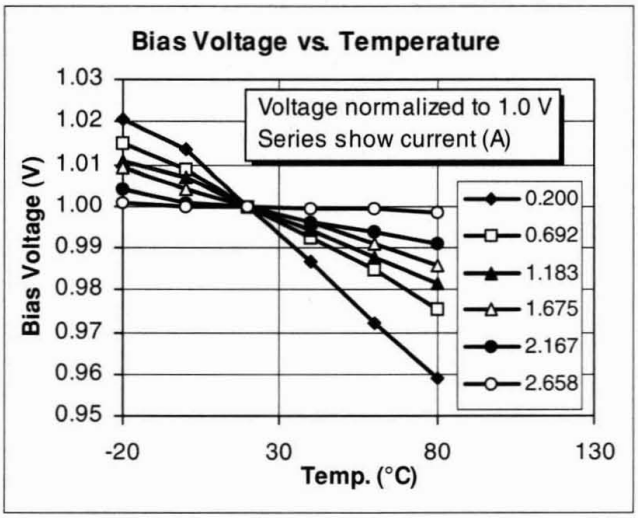



Intermodulation Distortion vs. Output Power
(as measured in a broadband circuit)
IMD (dBc)
Output Power (Watts-PEP)
V_{DD} = 28 V, I_{DQ} = 425 mA
f_1 = 2169 MHz, f_2 = 2170 MHz
3rd Order
5th
7th



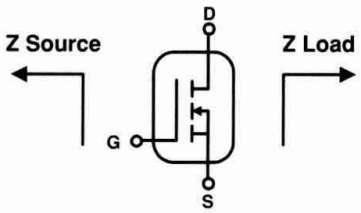


*This part is internally matched. Measurements of the finished product will not yield these figures.

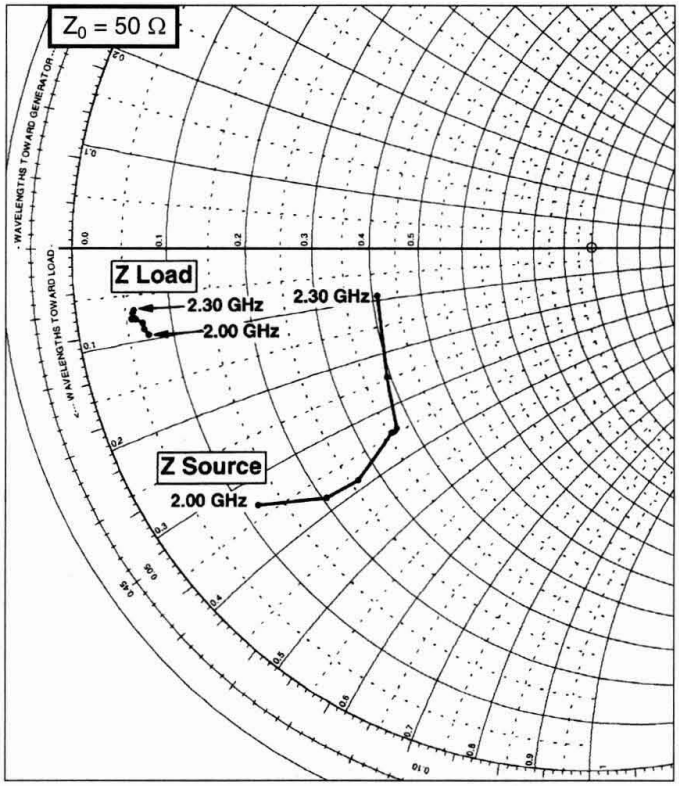


Impedance Data

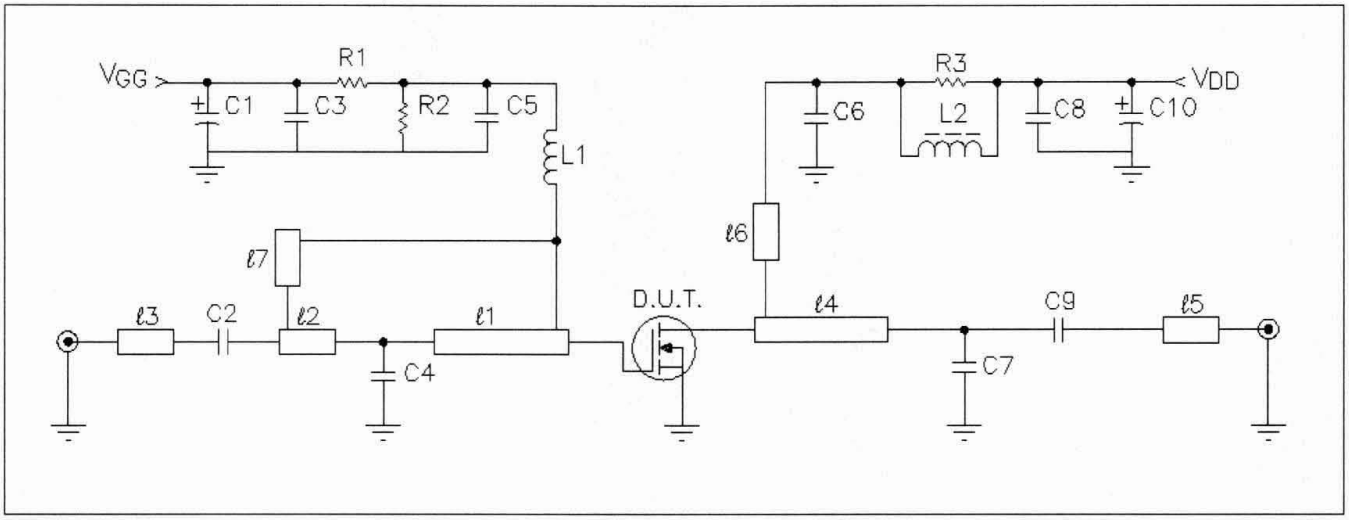
(V_{DD} = 28 V, P_{out} = 30 W, I_{DQ} = 425 mA)



Frequency	Z Source Ω		Z Load Ω	
GHz	R	jX	R	jX
2.00	6.0	-16.7	3.6	-4.7
2.10	10.3	-19.0	3.4	-4.4
2.12	13.2	-19.3	3.4	-4.1
2.15	17.9	-17.3	3.0	-3.8
2.17	18.5	-17.2	2.8	-3.8
2.20	19.6	-12.3	2.9	-3.5
2.30	20.5	-4.6	3.0	-3.3



Test Circuit



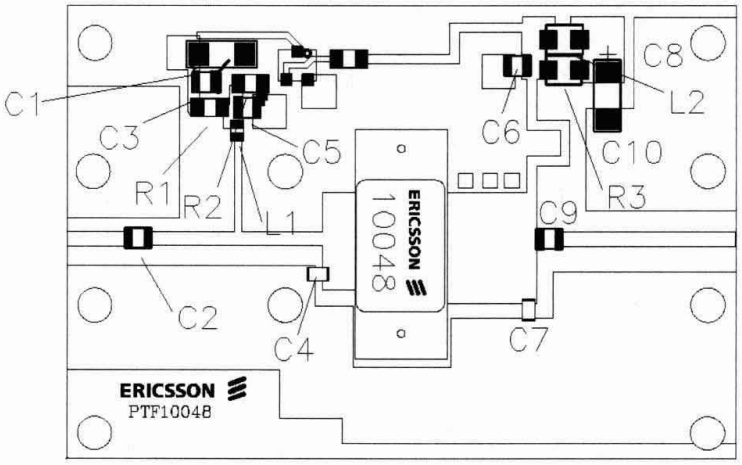
Test Circuit Schematic for f = 2.15 GHz

DUT	PTF 10048
ℓ1, ℓ2, ℓ5	Microstrip 50 Ω
ℓ3	0.048 λ 2.15 GHz Microstrip 11.52 Ω
ℓ4	0.145 λ 2.15 GHz Microstrip 10.4 Ω
C1, C2	10 pF, Tantulum Capacitor
C3, C4	0.1 µF, Chip Capacitor
C5, C6	13 pF, Chip Capacitor, ATC 100A
C7, C8	16 pF, Chip Capacitor, ATC 100A
C9	0.8 pF, Chip Capacitor, ATC 100A
C10	0.0-4.0 pF, Trimmer Capacitor, Johanson

L1, L2	4 Turn, #22 AWG
L3	4 mm SMT Ferrite Bead
R1, R2	390 Ω Chip Resistor, K1206
R3	10 Ω Chip Resistor, K1206
Circuit Board	.028" Dielectric Thickness, ε_r = 4.0, AlliedSignal, G200, 2 oz. copper

Bias Parts (not shown on layout)

R3	200 Ω Resistor
R4	2 K Resistor



Parts Layout (not to scale)

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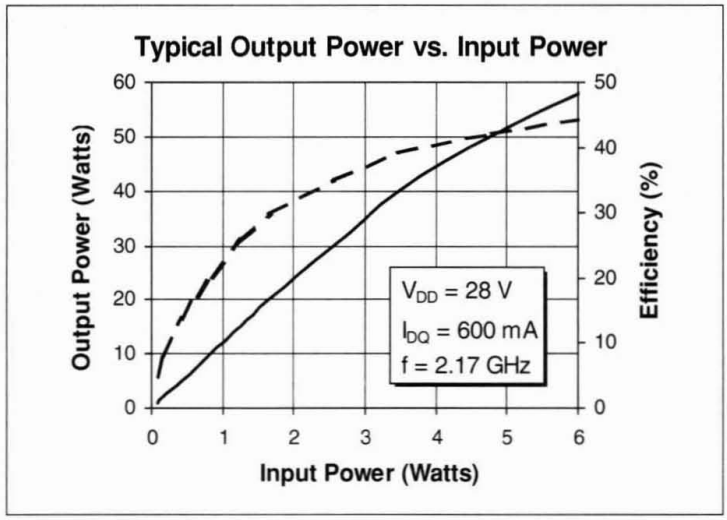
PTF 10122
50 Watts WCDMA, 2.1–2.2 GHz
GOLDMOS™ Field Effect Transistor

Description

The PTF 10122 is an internally matched common source N-channel enhancement-mode lateral MOSFET intended for WCDMA applications from 2.1 to 2.2 GHz. It is rated at 50 watts power output, with 11 dB of gain. Nitride surface passivation and full gold metallization ensure excellent device lifetime and reliability.

- ***INTERNALLY MATCHED***
- **Guaranteed Performance at 2.17 GHz, 28 V**
  - **Output Power = 50 Watts Min**
  - **Gain = 11.0 dB Typ**
  - **Efficiency = 35% Typ**
- **Full Gold Metallization**
- **Silicon Nitride Passivated**
- **Back Side Common Source**
- **Excellent Thermal Stability**
- **100% Lot Traceability**



Package 20248

RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{DD} = 28 V, P_{OUT} = 15 W, I_{DQ} = 600 mA, f = 2.11 GHz)	G_{ps}	10.0	11.0	—	dB
Power Output at 1 dB Compression (V_{DD} = 28 V, I_{DQ} = 600 mA, f = 2.17 GHz)	P-1dB	50	—	—	Watts
Drain Efficiency (V_{DD} = 28 V, P_{OUT} = 50 W, I_{DQ} = 600 mA, f = 2.17 GHz)	η_D	30	35	—	%
Load Mismatch Tolerance (V_{DD} = 28 V, P_{OUT} = 50 W, I_{DQ} = 600 mA, f = 2.17 GHz —all phase angles at frequency of test)	Ψ	—	—	10:1	—

All published data at T_{CASE} = 25°C unless otherwise indicated.

PTF 10122

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Electrical Characteristics (100% Tested)

Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 100 mA	$V_{(BR)DSS}$	65	—	—	Volts
Zero Gate Voltage Drain Current	V_{DS} = 28 V, V_{GS} = 0 V	I_{DSS}	—	—	2.0	mA
Gate Threshold Voltage	V_{DS} = 10 V, I_D = 150 mA	$V_{GS(th)}$	3.0	—	5.0	Volts
Forward Transconductance	V_{DS} = 10 V, I_D = 2 A	g_{fs}	—	4.0	—	Siemens

Maximum Ratings

Parameter	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	65	Vdc
Gate-Source Voltage	V_{GS}	±20	Vdc
Operating Junction Temperature	T_J	200	°C
Total Device Dissipation Above 25°C derate by	P_D	237 1.35	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{CASE} = 70°C)	$R_{\theta JC}$	0.74	°C/W

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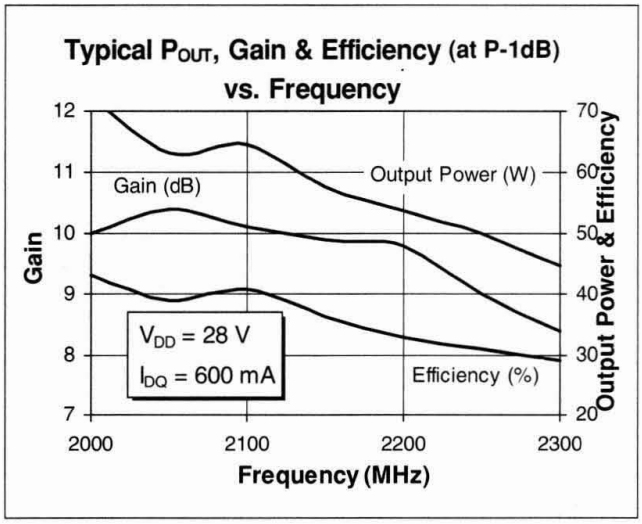
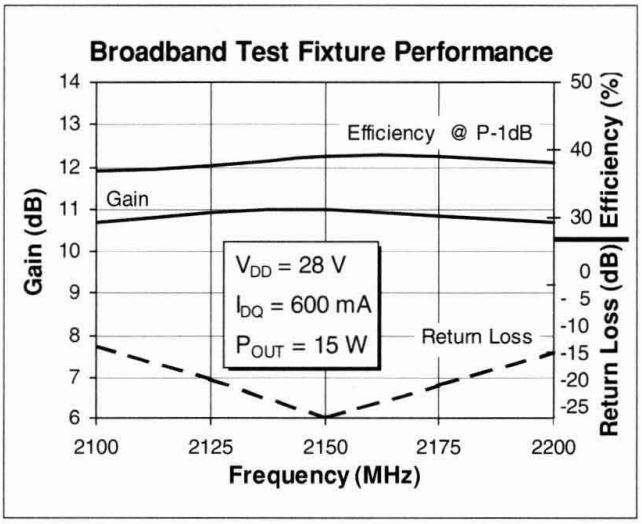
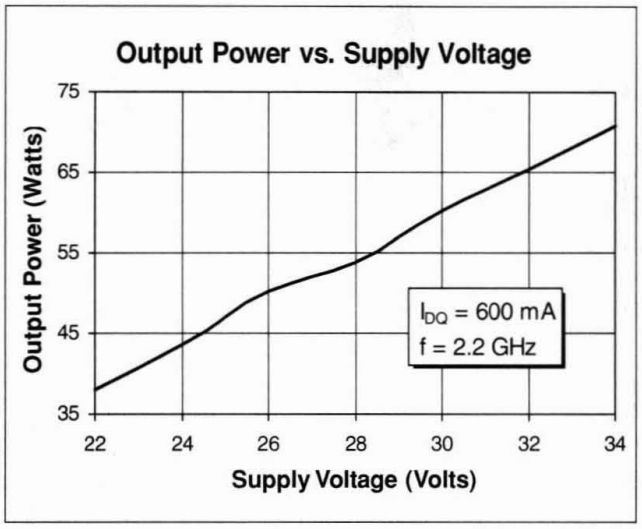
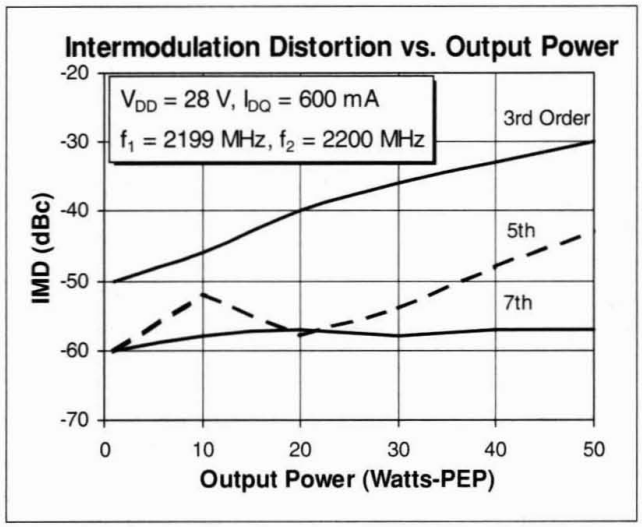
3

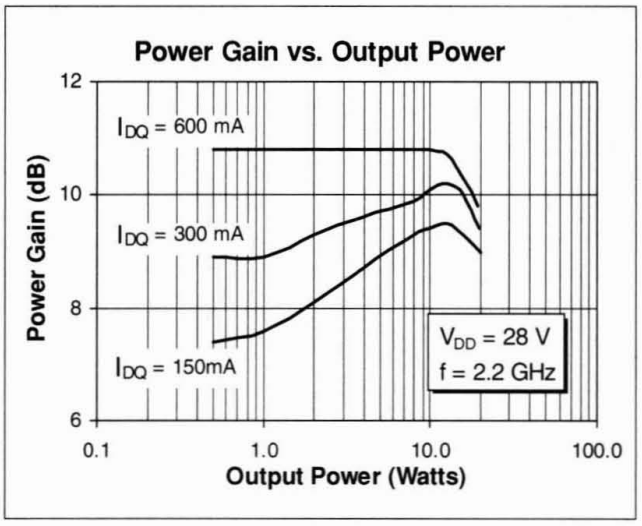
Typical Performance

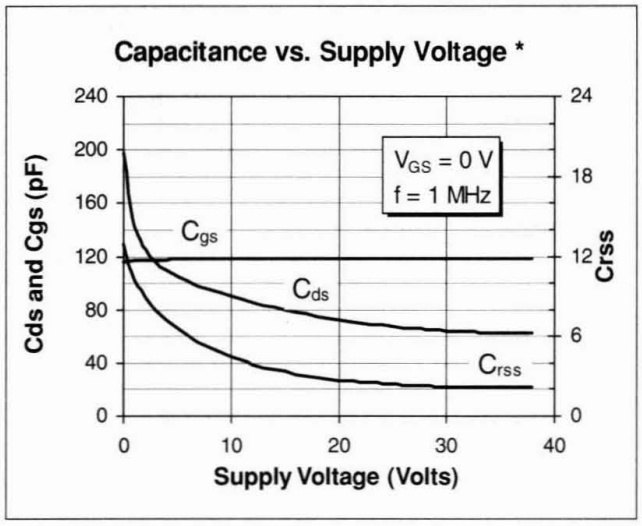




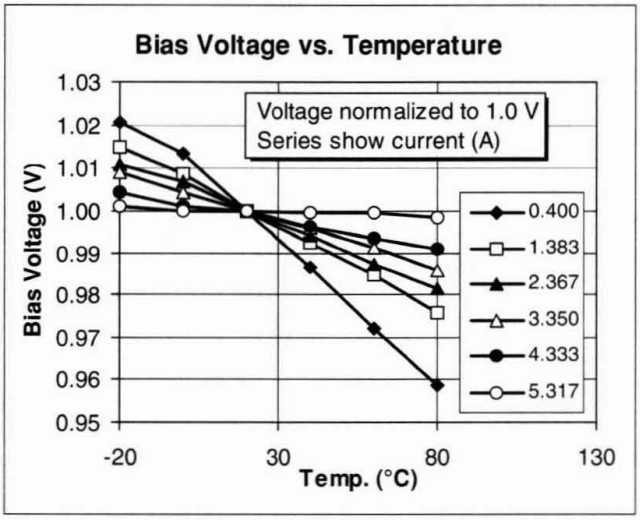








* This part is internally matched. Measurements of the finished product will not yield these results.



PTF 10122

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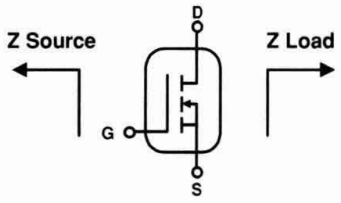
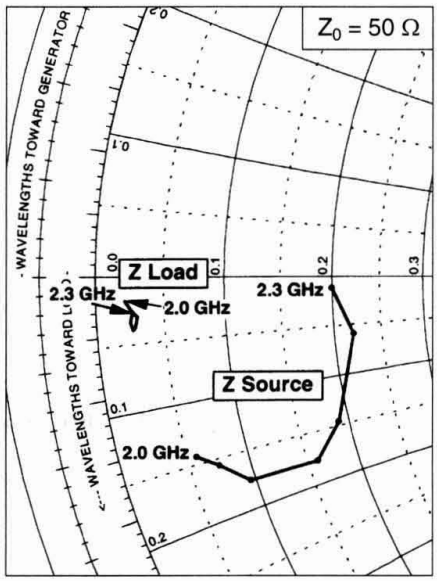
Impedance Data

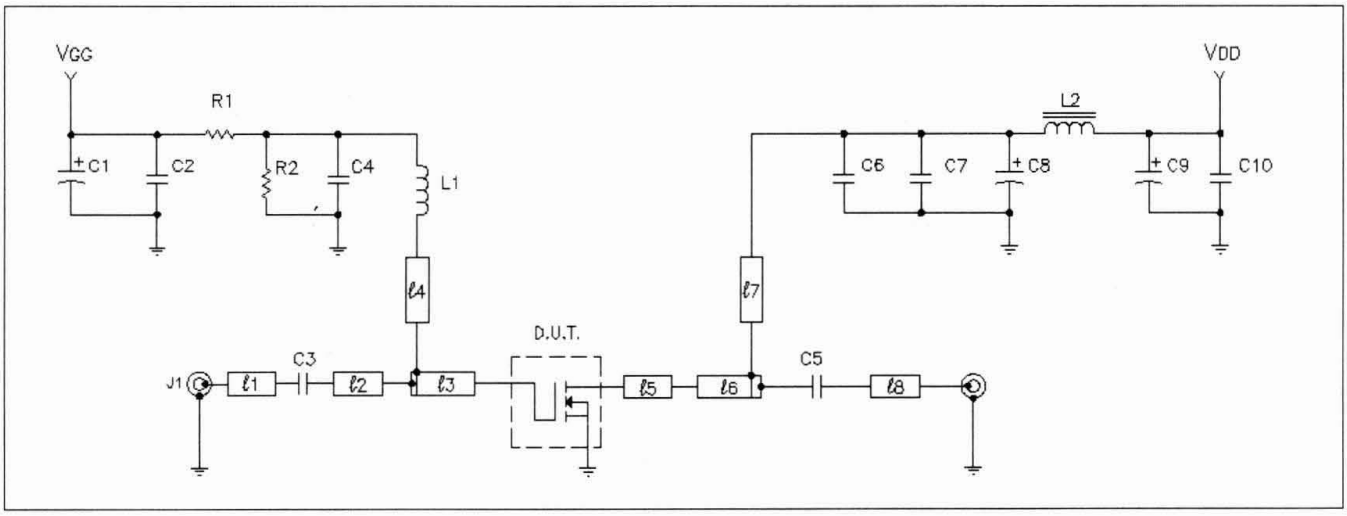
V_{DD} = 28 V, P_{OUT} = 50 W, I_{DQ} = 600 mA





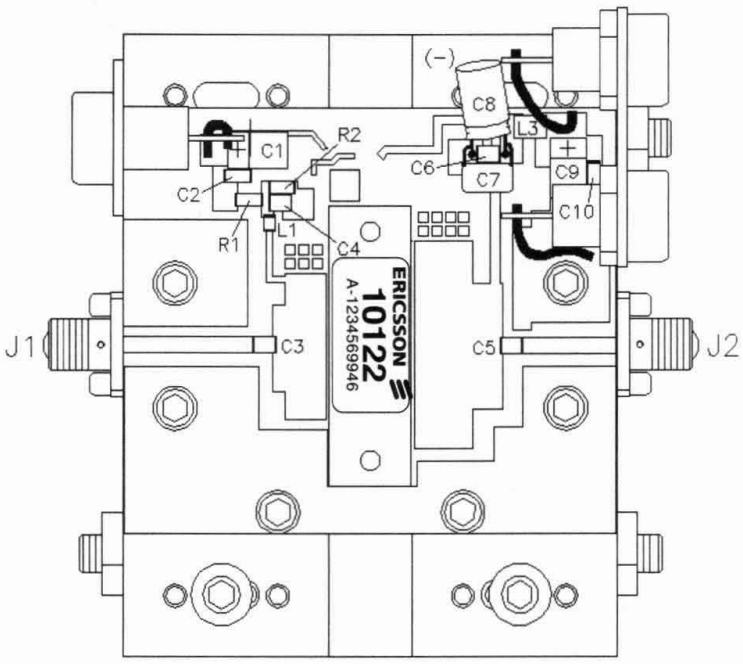
Frequency	Z Source Ω		Z Load Ω	
GHz	R	jX	R	jX
2.00	2.88	-7.20	1.05	-0.90
2.05	3.70	-7.80	1.30	-1.30
2.10	4.80	-8.80	1.50	-1.50
2.15	8.00	-8.90	1.40	-1.90
2.20	9.50	-7.30	1.30	-2.00
2.25	11.00	-3.00	1.22	-1.70
2.30	10.00	-0.60	1.30	-1.40

Test Circuit

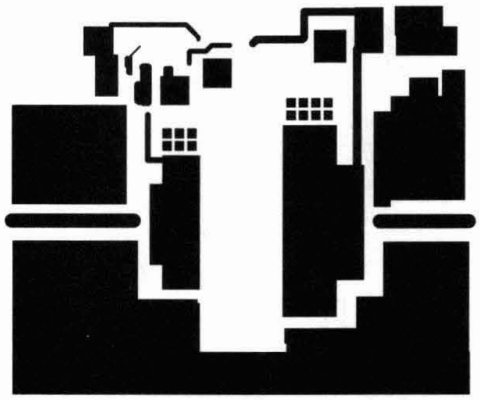


Test Circuit Block Diagram for f = 2.1–2.2 GHz

Q1	PTF 10122	LDMOS RF Transistor
ℓ1	.240 λ @ 2.15 GHz	Microstrip 50 Ω
ℓ2	.0281 λ @ 2.15 GHz	Microstrip 14.7 Ω
ℓ3	.085 λ @ 2.15 GHz	Microstrip 9.5 Ω
ℓ4	.104 λ @ 2.15 GHz	Microstrip 78 Ω
ℓ5	.120 λ @ 2.15 GHz	Microstrip 6.82 Ω
ℓ6	.063 λ @ 2.15 GHz	Microstrip 10.88 Ω
ℓ7	.216 λ @ 2.15 GHz	Microstrip 65 Ω
ℓ8	.174 λ @ 2.15 GHz	Microstrip 50 Ω
C1, C9	10 µF Chip Cap	ATC 100 B
C2, C10	0.1 µF Chip Cap	ATC 100 B
C3, C4, C5, C6	10 pF Chip Cap	ATC 100 B
C7	0.1 µF, 50 V	Digi-Key Capacitor 2.2 QBK
C8	100 µF, 50 V	Digi-Key Capacitor
L1	2.7 nH	Chip Inductor
L2	6mm	SMT Ferrite Bead
R1, R2	220 Ω Chip Resistor	Digi-Key 2.2 QBK
Circuit Board	Dielectric Thickness = 0.050", ε_r = 6.0 @ 1 MHz, 2 oz. Copper, TMM6, Rogers	



Parts Layout (not to scale)



Artwork (not to scale)

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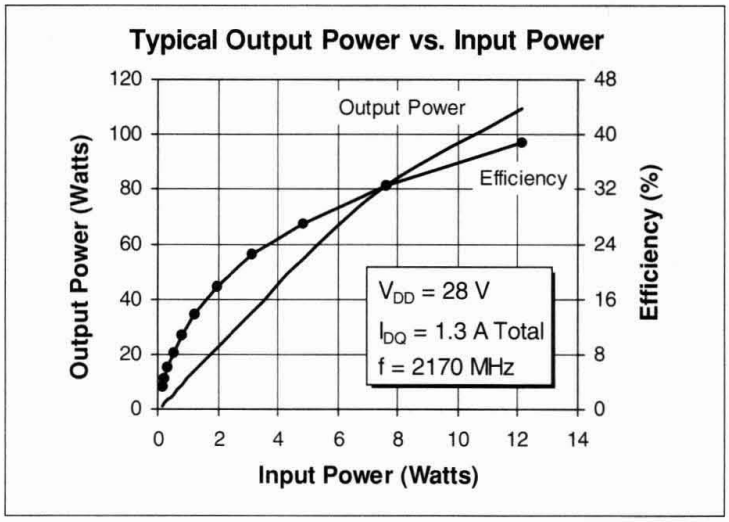
PRE-RELEASE PTF 10134*
100 Watts, 2.1–2.2 GHz
GOLDMOS™ Field Effect Transistor

Description

The PTF 10134 is an internally matched common source N–channel enhancement–mode lateral MOSFET intended for WCDMA applications from 2.1 to 2.2 GHz. It is rated at 100 watts power output. Nitride surface passivation and gold metallization ensure excellent device lifetime and reliability.

- ***INTERNALLY MATCHED***
- **Guaranteed Performance at 2.17 GHz, 28 V**
  - **Output Power = 100 Watts Min**
  - **Power Gain = 10 dB Typ**
- **Full Gold Metallization**
- **Silicon Nitride Passivated**
- **Back Side Common Source**
- **Excellent Thermal Stability**
- **100% lot traceability**



Package 20250

Maximum Ratings

Parameter	Symbol	Value	Unit
Drain-Source Voltage (1)	V_{DSS}	65	Vdc
Gate-Source Voltage (1)	V_{GS}	±20	Vdc
Operating Junction Temperature	T_J	200	°C
Total Device Dissipation at T_{flange} = 25°C Above 25°C derate by	P_D	440 2.51	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{flange} = 70°C)	$R_{\theta JC}$	0.39	°C/W

(1) per side

* Note: Specifications for this product are preliminary and subject to change without notice. Please contact your sales representative for further product information. Complete product infromation is available on our Website at: www.ericsson.com/rfpower.

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PTF 10134

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Electrical Characteristics (100% Tested—characteristics, conditions and limits shown per side)

Characteristic (per side)	Conditions	Symbol	Min	Typ	Max	Units
Drain-Source Breakdown Voltage	V_{GS} = 0 V, I_D = 100 mA	$V_{(BR)DSS}$	65	—	—	Volts
Zero Gate Voltage Drain Current	V_{DS} = 28 V, V_{GS} = 0 V	I_{DSS}	—	—	5.0	mA
Gate Threshold Voltage	V_{DS} = 10 V, I_D = 150 mA	$V_{GS(th)}$	3.0	—	5.0	Volts
Forward Transconductance	V_{DS} = 10 V, I_D = 2 A	g_{fs}	—	4.0	—	Siemens

RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{DD} = 28 V, P_{OUT} = 30 W, I_{DQ} = 1.3 A Total, f = 2.17 GHz)	G_{ps}	9.5	10	—	dB
Power Output at 1 dB Compression (V_{DD} = 28 V, I_{DQ} = 1.3 A Total, f = 2.17 GHz)	P-1dB	100	—	—	Watts
Drain Efficiency (V_{DD} = 28 V, P_{OUT} = 100 W, I_{DQ} = 1.3 A Total, f = 2.17 GHz)	η_D	—	37	—	%
Load Mismatch Tolerance (V_{DD} = 28 V, P_{OUT} = 60 W, I_{DQ} = 1.3 A Total, f = 2.17 GHz —all phase angles at frequency of test)	Ψ	—	—	10:1	—

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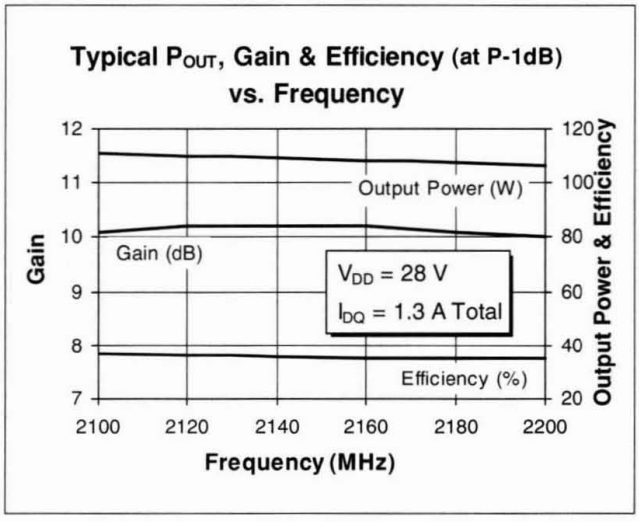
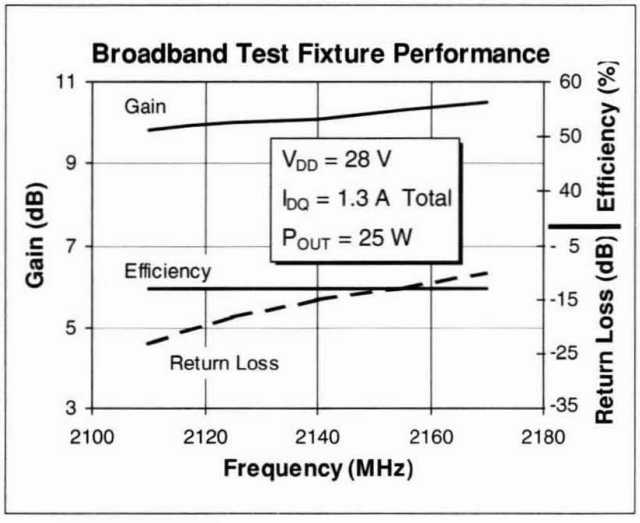
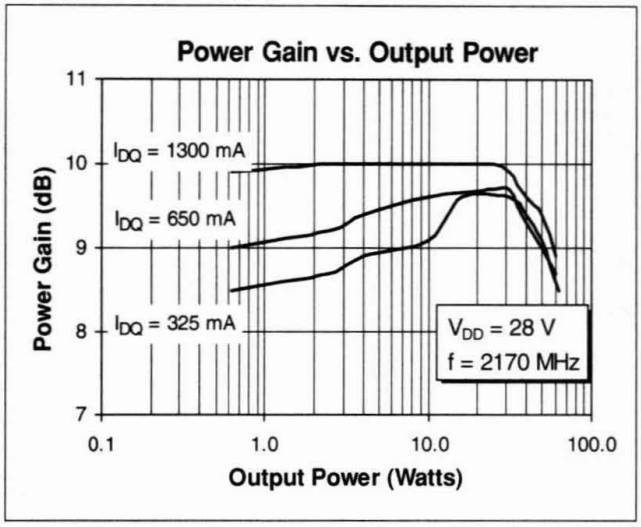
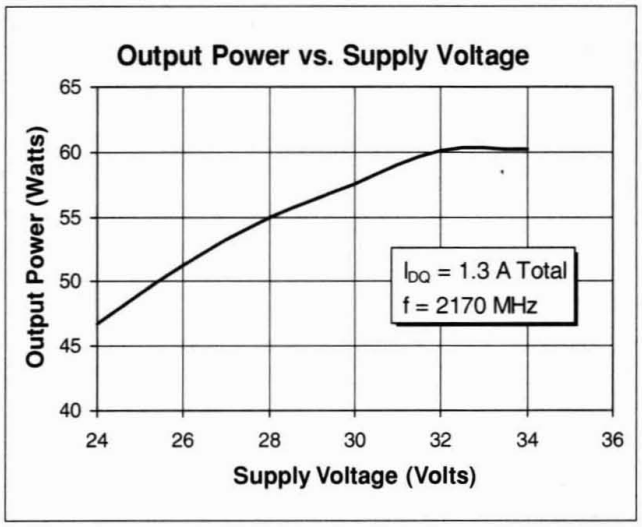
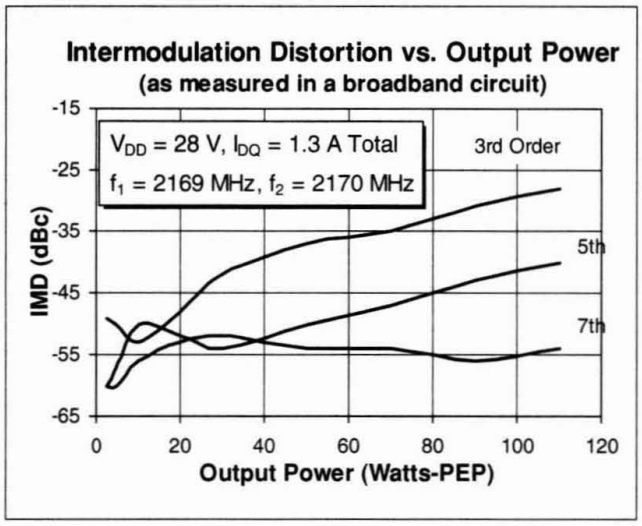
Typical Performance

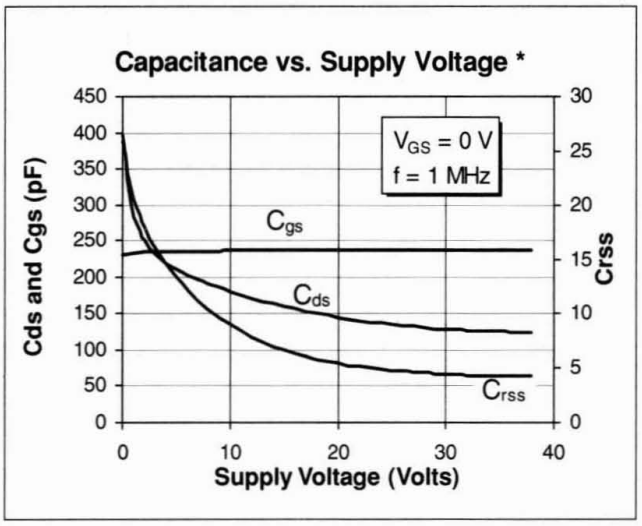




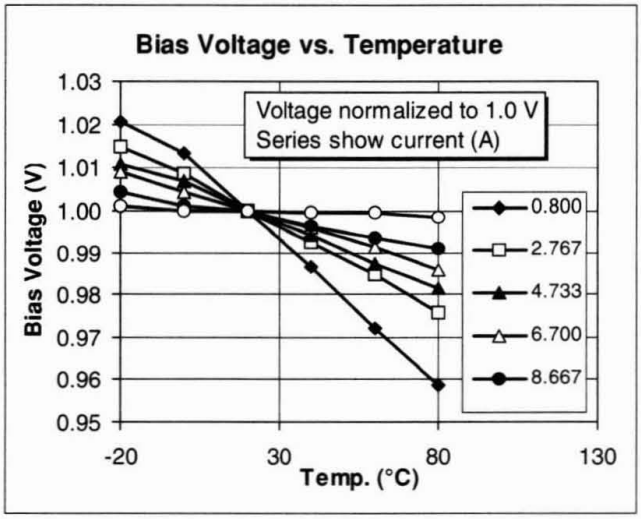








* This part is internally matched. Measurements of the finished product will not yield these results.



PTF 10134

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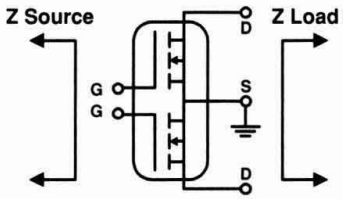
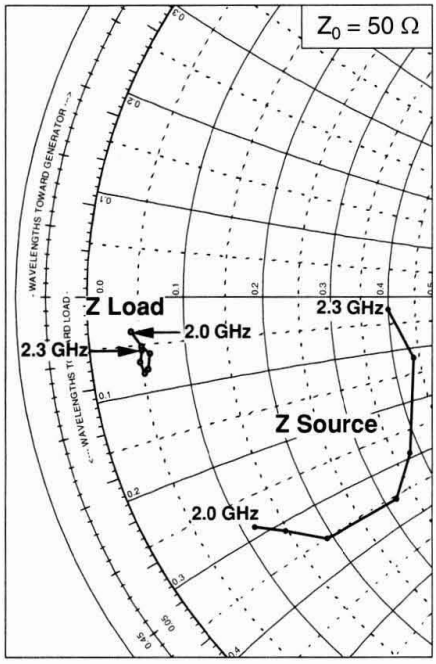
Impedance Data

(V_{DD} = 28 V, P_{OUT} = 100 W,
I_{DQ} = 1.3 A Total)



Frequency	Z Source Ω		Z Load Ω	
GHz	R	jX	R	jX
2.00	5.76	-14.40	2.10	-1.80
2.05	7.40	-15.60	2.60	-2.60
2.10	9.60	-17.60	3.00	-3.00
2.15	16.00	-17.80	2.80	-3.80
2.20	19.00	-14.60	2.60	-4.00
2.25	22.00	-6.00	2.44	-3.40
2.30	20.00	-1.20	2.60	-2.80



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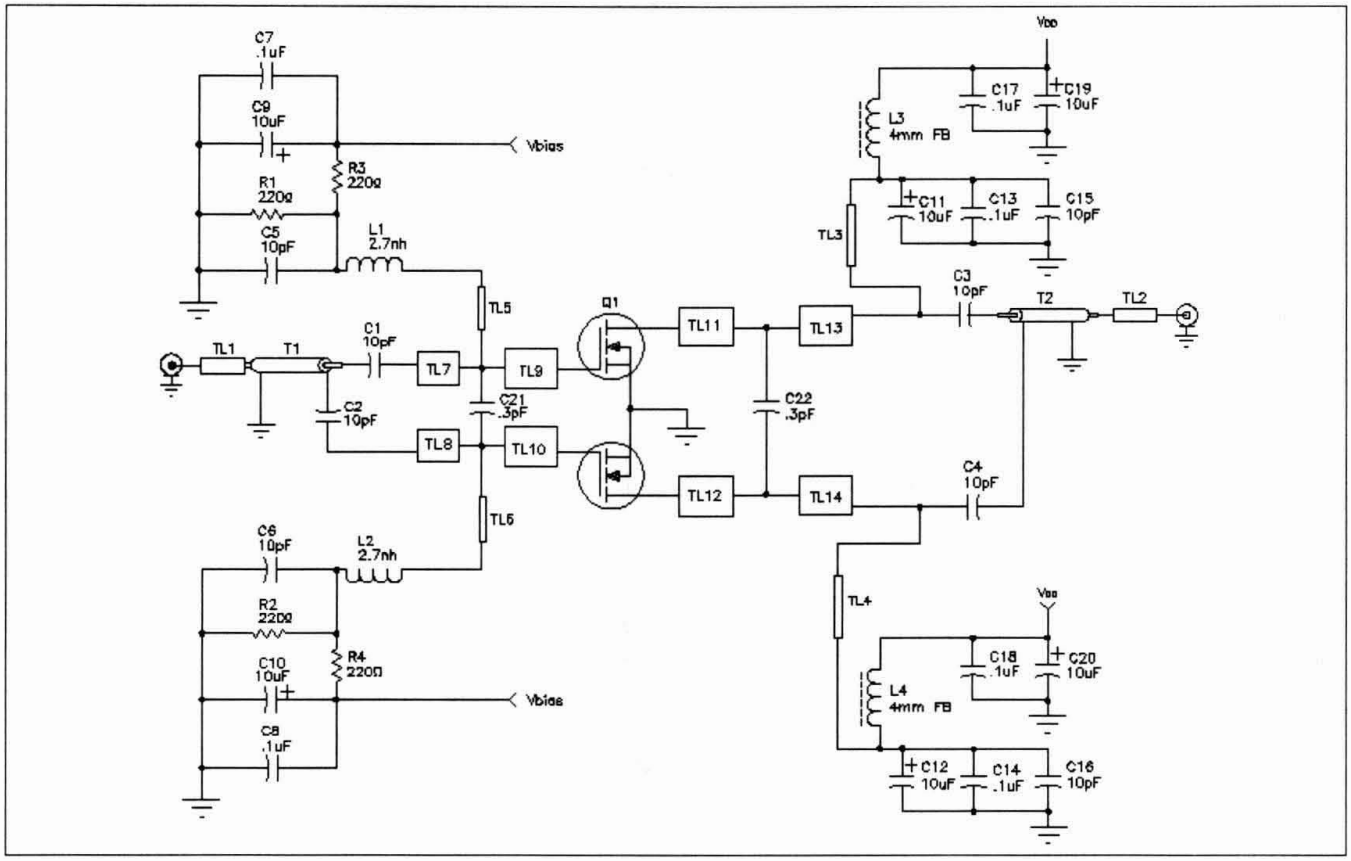
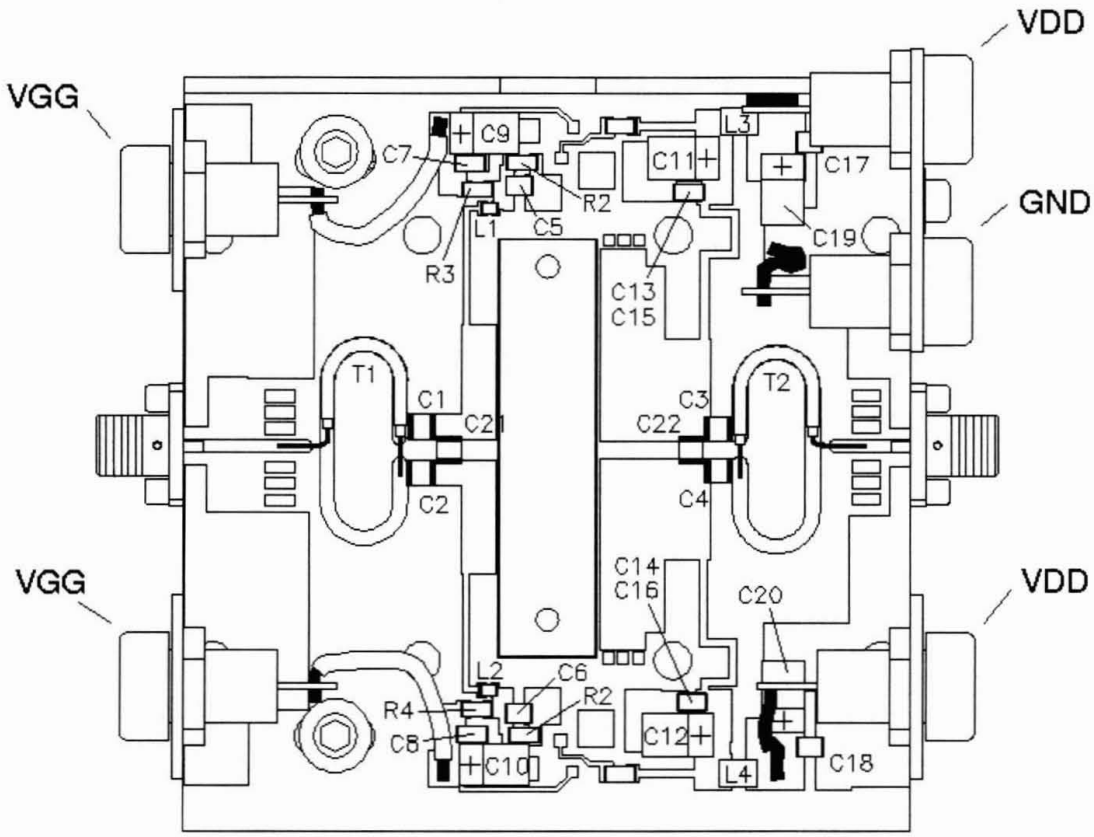
Test Circuit



Test Circuit Block Diagram for f = 2.2 GHz

C1,C2,C3,C4,C5,C6,C15,C16	ATC 100B	Capacitor,10pF
C7,C8,C13,C14	Digi-Key P4525-ND	Capacitor, 0.1 µF
C9,C10,C11,C12,C19,C20	Digi-Key PC56106-ND	Capacitor,10 µF 35VDC
C17,C18	ATC 100B	Capacitor, 0.1 µF
C21,C22	ATC 100B	Capacitor, 0.3pF
R1,R2,R3,R4	Digi-Key P220ECT-ND	Resistor, 220 Ω
L1,L2	TOKO,# LL2012-F2N7S	COIL, 2.7nh,SMT
L3,L4	PHILIPS,#BDS31314-6-452	Ferrite Bead, 4mm
T1,T2		Semi-rigid Coaxial Cable, 50 Ω
Circuit Board	Roger Microwave	PCB,TMM4, Er 6.0, THICKNESS 0.30, 2 OZ COPPER



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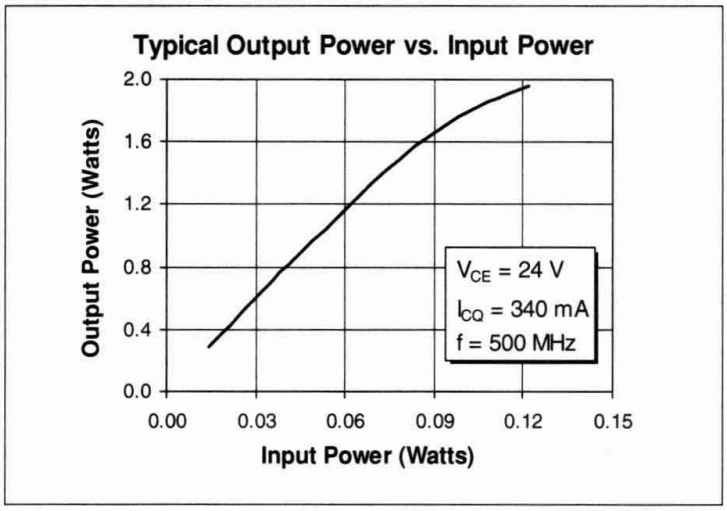
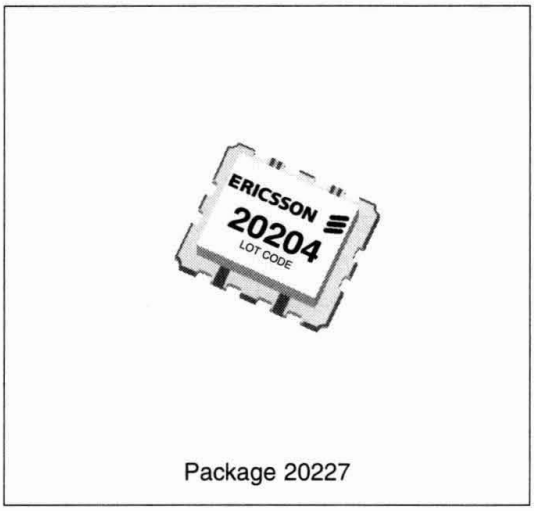
PTB 20204
1.0 Watt, 380–500 MHz
RF Power Transistor

Description

The PTB 20204 is a class A, NPN, common emitter RF power transistor intended for 24 Vdc operation from 380 to 500 MHz. Rated at 1.0 watt minimum output power, it may be used for both CW and PEP applications. Ion implantation, nitride surface passivation and gold metallization ensure excellent device reliability. 100% lot traceability is standard.

- 1.0 Watt, 380–500 MHz
- Class A Characteristics
- -40 dB Max Two-Tone IMD at 1.0 W(PEP)
- Gold Metallization
- Silicon Nitride Passivated





Package 20227

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CER}	60	Vdc
Collector-Base Voltage	V_{CBO}	60	Vdc
Emitter-Base Voltage (collector open)	V_{EBO}	4.0	Vdc
Collector Current (continuous)	I_C	0.5	Adc
Total Device Dissipation at T_{flange} = 25°C Above 25°C derate by	P_D	11 0.0625	Watts W/°C
Storage Temperature Range	T_{STG}	-40 to +150	°C
Thermal Resistance (T_{flange} = 70°C)	$R_{\theta JC}$	16	°C/W

PTB 20204

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Electrical Characteristics (100% Tested)

Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Breakdown Voltage C to E	I_B = 0 A, I_C = 5 mA	$V_{(BR)CEO}$	25	30	—	Volts
Breakdown Voltage C to E	V_{BE} = 0 V, I_C = 5 mA	$V_{(BR)CES}$	70	—	—	Volts
Breakdown Voltage E to B	I_C = 0 A, I_E = 5 mA	$V_{(BR)EBO}$	4	5	—	Volts
DC Current Gain	V_{CE} = 5 V, I_C = 250 mA	h_{FE}	20	40	—	—
Output Capacitance	V_{CB} = 24 V, I_E = 0 A, f = 1 MHz	C_{obo}	—	4.4	—	pF

RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{CE} = 24 Vdc, P_{OUT} = 1.0 W, I_{CQ} = 340 mA, f = 500 MHz)	G_{pe}	12.5	13.5	—	dB
Two-Tone Intermodulation Distortion (V_{CE} = 24 Vdc, P_{OUT} = 1.0 W(PEP), I_{CQ} = 340 mA, f_1 = 500 MHz, f_2 = 501 MHz)	IM_2	—	-44	-40	dB
Load Mismatch Tolerance (V_{CE} = 24 Vdc, P_{OUT} = 2 W, I_{CQ} = 340 mA, f = 500 MHz—all phase angles at frequency of test)	Ψ	—	—	30:1	—

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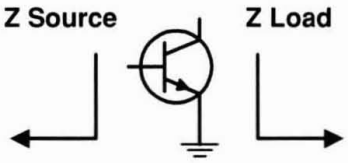
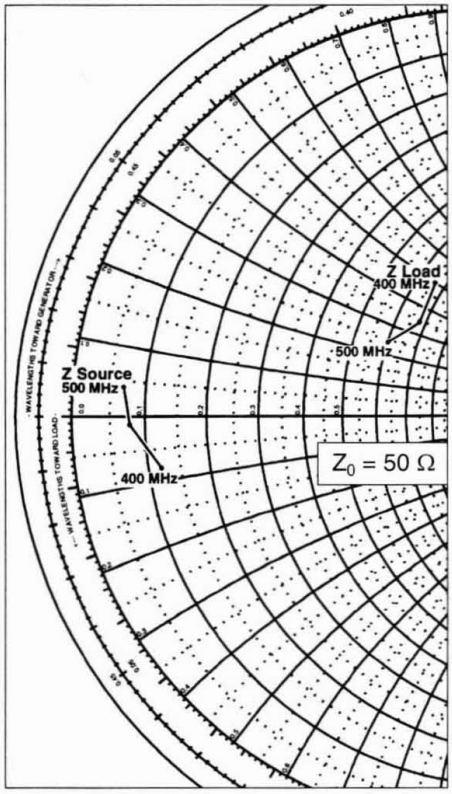
Impedance Data (data shown for fixed-tuned broadband circuit)

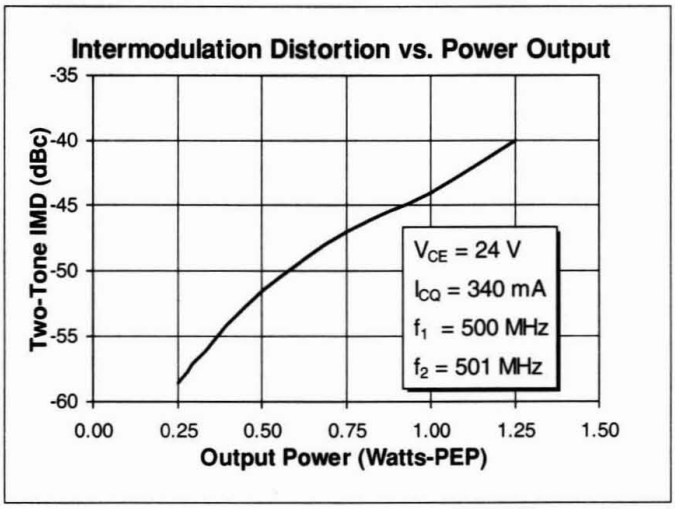
(V_{CE} = 24 Vdc, P_{OUT} = 1.0 W, I_{CQ} = 340 mA)



Frequency	Z Source Ω		Z Load Ω	
MHz	R	jX	R	jX
400	6.0	-4.0	33.2	24.9
450	3.9	-0.6	34.0	17.3
500	3.4	2.1	30.1	12.2



Typical Performance



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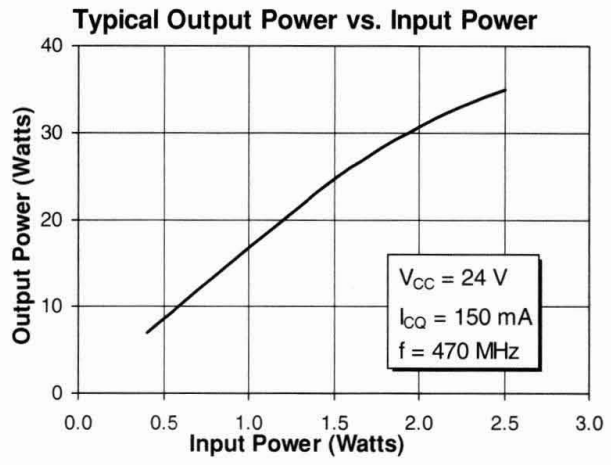
ERICSSON

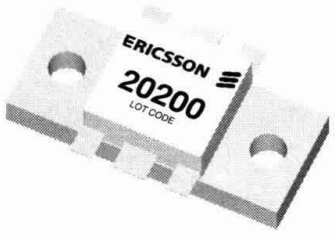
PTB 20200
30 Watts, 380–500 MHz
RF Power Transistor

Description

The PTB 20200 is a class AB, NPN, common emitter RF power transistor intended for 24 Vdc operation from 380–500 MHz. Rated at 30 watts minimum output power, it may be used for both CW and PEP applications. Ion implantation, nitride surface passivation and gold metallization are used to ensure excellent device reliability. 100% lot traceability is standard.

- 30 Watts, 380–500 MHz
- Class AB Characteristics
- Gold Metallization
- Silicon Nitride Passivated





Package 20200

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CEO}	30	Vdc
Collector-Base Voltage	V_{CBO}	65	Vdc
Emitter-Base Voltage (collector open)	V_{EBO}	4.0	Vdc
Collector Current (continuous)	I_C	6.7	Adc
Total Device Dissipation at T_{flange} = 25°C Above 25°C derate by	P_D	150 1.0	Watts W/°C
Storage Temperature	T_{stg}	150	°C
Thermal Resistance (T_{flange} = 70°C)	$R_{\theta JC}$	1.0	°C/W

Electrical Characteristics (100% Tested)

Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Breakdown Voltage C to E	I_B = 0 A, I_C = 10 mA	$V_{(BR)CEO}$	30	—	—	Volts
Breakdown Voltage C to E	V_{BE} = 0 V, I_C = 10 mA	$V_{(BR)CES}$	55	70	—	Volts
Breakdown Voltage E to B	I_C = 0 A, I_E = 10 mA	$V_{(BR)EBO}$	3.5	—	—	Volts
DC Current Gain	V_{CE} = 5 V, I_C = 1 A	h_{FE}	20	50	100	—

RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{CC} = 24 Vdc, P_{OUT} = 30 W, I_{CQ} = 150 mA, f = 500 MHz)	G_{pe}	10.0	11.5	—	dB
Collector Efficiency (V_{CC} = 24 Vdc, P_{OUT} = 30 W, I_{CQ} = 150 mA, f = 500 MHz)	η_C	—	50	—	%
Intermodulation Distortion (V_{CC} = 24 Vdc, P_{OUT} = 30 W(PEP), I_{CQ} = 150 mA, f_1 = 469 MHz, f_2 = 470 MHz)	IMD	—	-30	—	dBc
Load Mismatch Tolerance (V_{CC} = 24 Vdc, P_{OUT} = 30 W, I_{CQ} = 150 mA, f = 500 MHz—all phase angles at frequency of test)	Ψ	—	—	10:1	—

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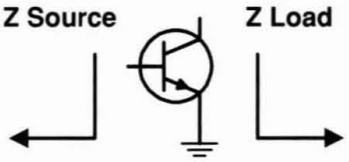
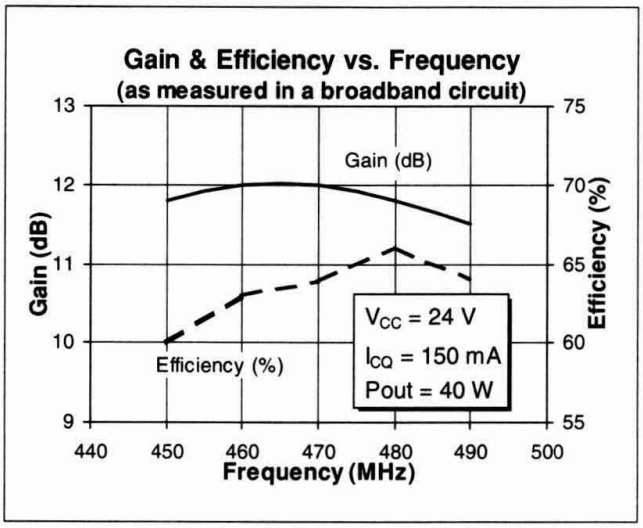
Impedance Data (data shown for fixed-tuned broadband circuit)

V_{CC} = 24 Vdc, P_{OUT} = 30 W, I_{CQ} = 150 mA



Frequency	Z Source Ω		Z Load Ω	
MHz	R	jX	R	jX
450	0.9	-3.3	2.4	0.1
470	0.8	-2.9	2.4	0.7
490	0.8	-2.5	2.4	1.3

Typical Performance



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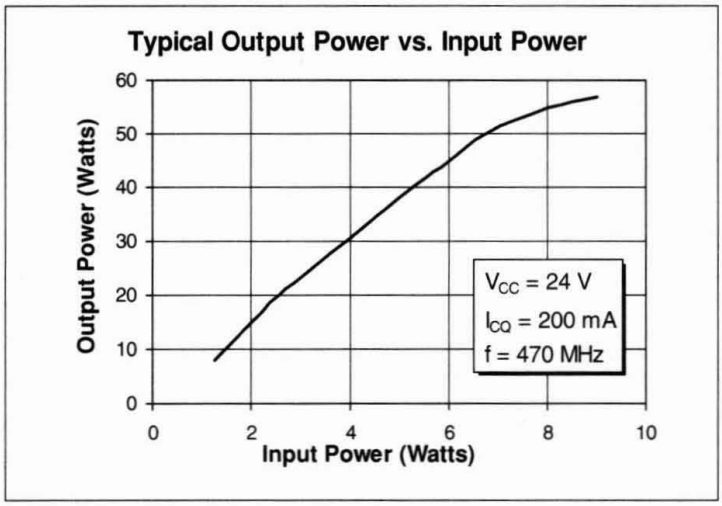
ERICSSON

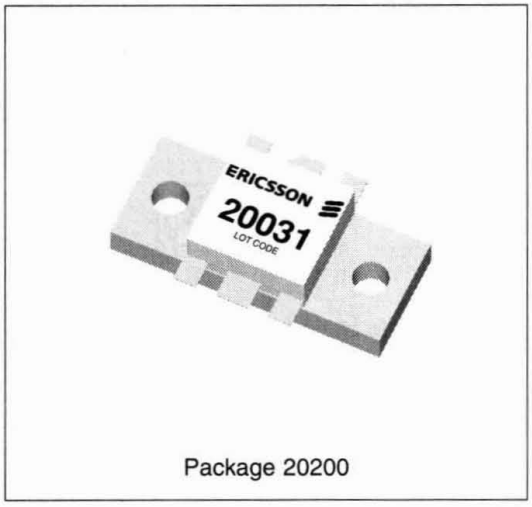
PTB 20031
40 Watts, 420–470 MHz
RF Power Transistor

Description

The PTB 20031 is a class AB, NPN, common emitter RF power transistor intended for 24 Vdc operation from 420 to 470 MHz. It is rated at 40 watts minimum output power, and may be used for both CW and PEP applications. Ion implantation, nitride surface passivation and gold metallization are used to ensure excellent device reliability. 100% lot traceability is standard.

- 40 Watts, 420–470 MHz
- Class AB Characteristics
- 50% Collector Efficiency at 40 Watts
- Gold Metallization
- Silicon Nitride Passivated





Package 20200

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CER}	40	Vdc
Collector-Base Voltage	V_{CBO}	50	Vdc
Emitter-Base Voltage (collector open)	V_{EBO}	4.0	Vdc
Collector Current (continuous)	I_C	10.0	Adc
Total Device Dissipation at T_{flange} = 25°C Above 25°C derate by	P_D	175 1.0	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{flange} = 70°C)	$R_{\theta JC}$	1.0	°C/W

Electrical Characteristics (100% Tested)

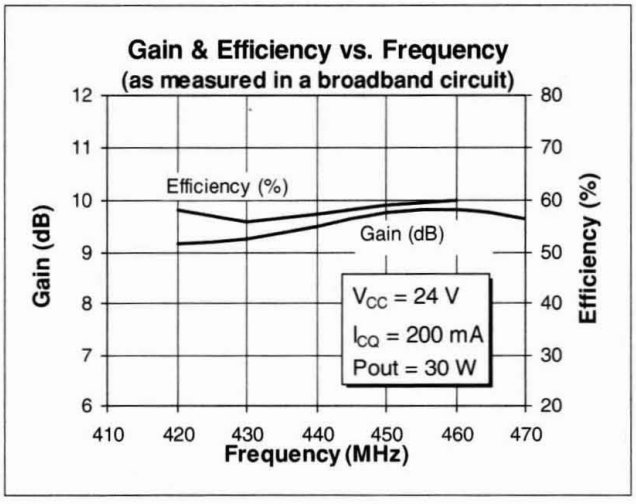
Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Breakdown Voltage C to E	I_B = 0 A, I_C = 100 mA	$V_{(BR)CEO}$	25	30	—	Volts
Breakdown Voltage C to E	V_{BE} = 0 V, I_C = 100 mA	$V_{(BR)CES}$	50	70	—	Volts
Breakdown Voltage E to B	I_C = 0 A, I_E = 5 mA	$V_{(BR)EBO}$	3.5	5	—	Volts
DC Current Gain	V_{CE} = 5 V, I_C = 1 A	h_{FE}	20	50	120	—

RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{CC} = 24 Vdc, P_{OUT} = 40 W, I_{CQ} = 200 mA, f = 420–470 MHz)	G_{pe}	8.0	9.5	—	dB
Collector Efficiency (V_{CC} = 24 Vdc, P_{OUT} = 40 W, I_{CQ} = 200 mA, f = 420–470 MHz)	η_C	50	—	—	%
Intermodulation Distortion (V_{CC} = 24 Vdc, P_{OUT} = 40 W(PEP), I_{CQ} = 200 mA, f_1 = 469 MHz, f_2 = 470 MHz)	IMD	—	-22	—	dBc
Load Mismatch Tolerance (V_{CC} = 24 Vdc, P_{OUT} = 40 W, I_{CQ} = 200 mA, f = 420–470 MHz —all phase angles at frequency of test)	Ψ	—	—	5:1	—

3

Typical Performance



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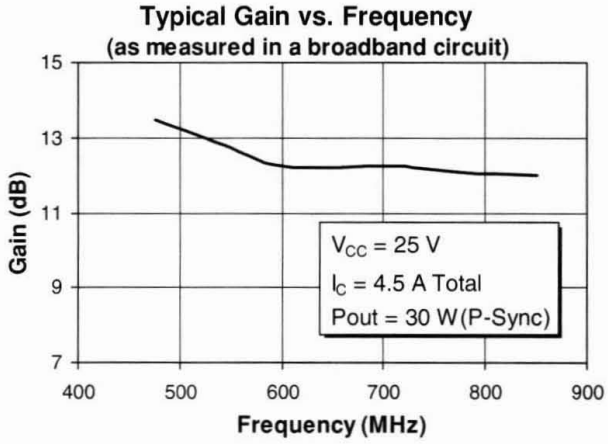
ERICSSON

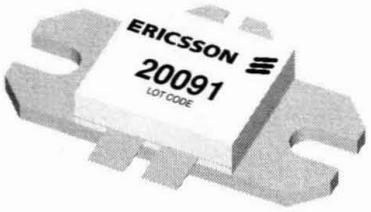
PTB 20091
30 Watts, 470–860 MHz
UHF TV Linear Power Transistor

Description

ThePTB 20091 is an NPN, common emitter RF power transistor intended for 25 Vdc class A operation from 470 to 860 MHz. It is rated at 30 watts P-sync output power. Ion implantation, nitride surface passivation and gold metallization are used to ensure excellent device reliability. 100% lot traceability is standard.

- 30 Watts (P-Sync), 470–860 MHz
- Class A Characteristics
- Silicon Nitride Passivated
- Gold Metallization
- Excellent Linearity





Package 20212

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage (1)	V_{CEO}	30	Vdc
Collector-Base Voltage (1)	V_{CBO}	65	Vdc
Emitter-Base Voltage (collector open)	V_{EBO}	4.0	Vdc
Collector Current (continuous)	I_C	6.7	Adc
Total Device Dissipation at T_{flange} = 25°C Above 25°C derate by	P_D	150 1.33	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{flange} = 70°C)	$R_{\theta JC}$	.75	°C/W

(1)per side

Electrical Characteristics (100% Tested—characteristics, conditions and limits shown per side)

Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Breakdown Voltage C to E	I_B = 0 A, I_C = 100 mA	$V_{(BR)CEO}$	25	30	—	Volts
Breakdown Voltage C to E	V_{BE} = 0 V, I_C = 100 mA	$V_{(BR)CES}$	55	70	—	Volts
Breakdown Voltage E to B	I_C = 0 A, I_E = 5 mA	$V_{(BR)EBO}$	3.5	5	—	Volts
DC Current Gain	V_{CE} = 5 V, I_C = 1 A	h_{FE}	20	50	100	—
Output Capacitance (per side)	V_{CB} = 28 V, I_E = 0 A, f = 1 MHz	Cob	—	45	—	pF

RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{CC} = 25 Vdc, P_{OUT} = 30 W(P-sync), I_C = 4.5 A Total, f = 470–860 MHz)	G_{pe}	11	12	—	dB
Intermodulation Distortion (V_{CC} = 25 Vdc, P_{OUT} = 27.5 W(P-sync), I_C = 4.5 A Total, f_1 = 860 MHz, Vision = -8dB, f_2 = 863.5 MHz, Subcarrier = -16dB, f_3 = 864.5 MHz, Sound = -7dB)	IM_3	—	-50	—	dBc
Load Mismatch Tolerance (V_{CC} = 25 Vdc, P_{OUT} = 30 $W_{(P\text{-sync})}$, I_C = 4.5 A Total, f = 470–860 MHz—all phase angles at frequency of test)	Ψ	—	—	10:1	—

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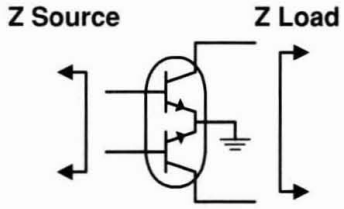
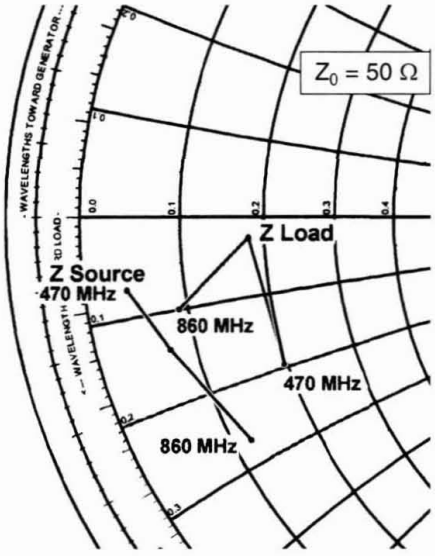
Impedance Data (data shown for fixed-tuned broadband circuit)

(V_{CC} = 25 Vdc, P_{OUT} = 30 $W_{(P\text{-sync})}$, I_C = 4.5 A Total)



Frequency	Z Source Ω		Z Load Ω	
MHz	R	jX	R	jX
470	2.0	-3.6	9.8	-9.8
650	3.6	-7.0	9.0	-1.3
860	6.0	-13.5	4.5	-5.0



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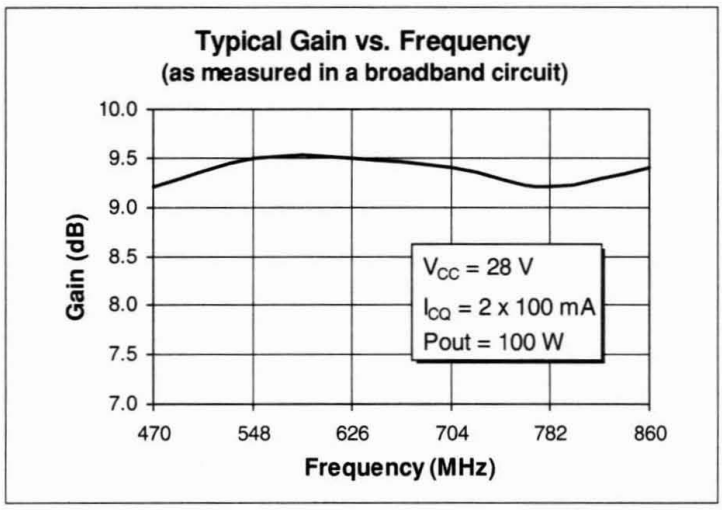
ERICSSON

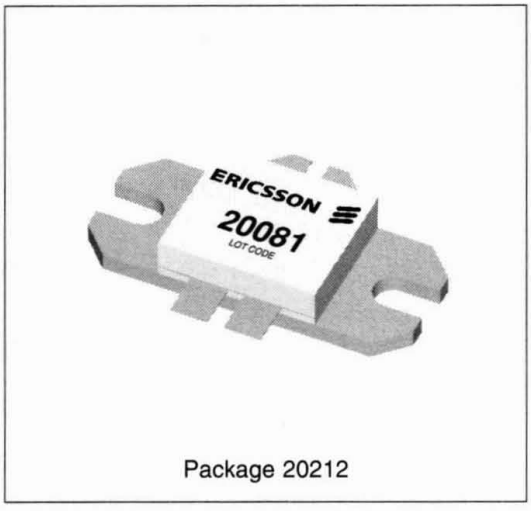
PTB 20081
150 Watts, 470–860 MHz
UHF TV Power Transistor

Description

The PTB 20081 is a class AB, NPN, common emitter RF power transistor intended for 28 to 32 Vdc operation across the 470 to 860 MHz UHF TV frequency band. It is rated at 100 watts minimum output power. Ion implantation, nitride surface passivation and gold metallization are used to ensure excellent device reliability. 100% lot traceability is standard.

- 150 Watts (P-Sync), 470–860 MHz
- Class AB Characteristics
- 55% Collector Efficiency at 100 Watts (CW)
- Guaranteed Performance at 28 Volts, 860 MHz
  - Output Power = 125 Watts (Peak Sync)
  - Output Power = 100 Watts (CW)
  - Minimum Gain = 8.5 dB
- Guaranteed Performance at 32 Volts, 860 MHz
  - Output Power = 150 Watts (Peak Sync)





Package 20212

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage (1)	V_{CER}	40	Vdc
Collector-Base Voltage (1)	V_{CBO}	65	Vdc
Emitter-Base Voltage (collector open)	V_{EBO}	4.0	Vdc
Collector Current (continuous)	I_C	12	Adc
Total Device Dissipation at T_{flange} = 25°C Above 25°C derate by	P_D	233 1.33	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{flange} = 70°C)	$R_{\theta JC}$	0.75	°C/W

(1)per side

Electrical Characteristics (100% Tested—characteristics, conditions and limits shown per side)

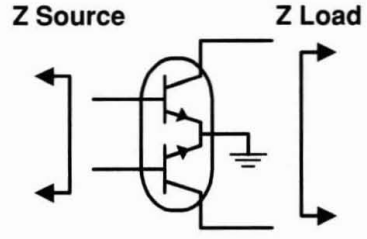
Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Breakdown Voltage C to E	I_B = 0 A, I_C = 100 mA	$V_{(BR)CEO}$	25	30	—	Volts
Breakdown Voltage C to E	V_{BE} = 0 V, I_C = 100 mA	$V_{(BR)CES}$	55	70	—	Volts
Breakdown Voltage E to B	I_C = 0 A, I_E = 5 mA	$V_{(BR)EBO}$	3.5	5	—	Volts
DC Current Gain	V_{CE} = 5 V, I_C = 1 A	h_{FE}	20	50	100	—
Output Capacitance (each side)	V_{CB} = 28 V, I_E = 0 A, f = 1 MHz	Cob	—	45	—	pF

RF Specifications (100% Tested)

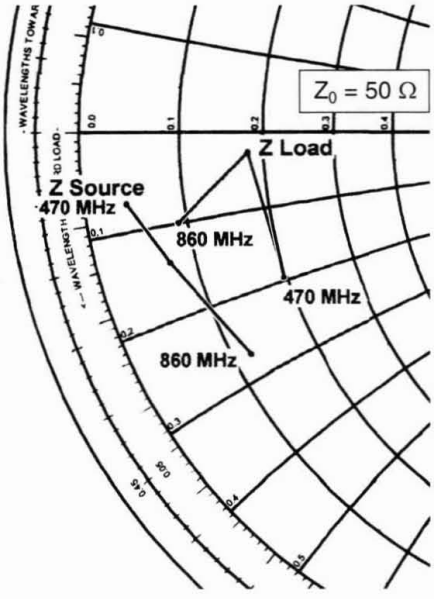
Characteristic	Symbol	Min	Typ	Max	Units
Power Output (V_{CC} = 28 Vdc, I_{CQ} = 2 x 100 mA, f = 860 MHz)	P_{out}	100	110	—	Watts
Power Output (P-Sync.) (V_{CC} = 28 Vdc, I_{CQ} = 2 x 100 mA, f = 860 MHz)	P_{out}	125	135	—	Watts
Power Out (P-Sync.) (V_{CC} = 32 Vdc, I_{CQ} = 2 x 100 mA, f = 860 MHz)	P_{out}	150	160	—	Watts
Gain (V_{CC} = 28 Vdc, P_{OUT} = 100 W, I_{CQ} = 2 x 100 mA, f = 860 MHz)	G_{pe}	8.5	9.5	—	dB
Collector Efficiency (V_{CC} = 28 Vdc, P_{OUT} = 100 W, I_{CQ} = 2 x 100 mA, f = 860 MHz)	η_C	55	58	—	%
Load Mismatch Tolerance (V_{CC} = 28 Vdc, P_{OUT} = 100 $W_{(PEP)}$, f = 860 MHz— all phase angles at frequency of test)	Ψ	—	—	10:1	—

Impedance Data (data shown for fixed-tuned broadband circuit)

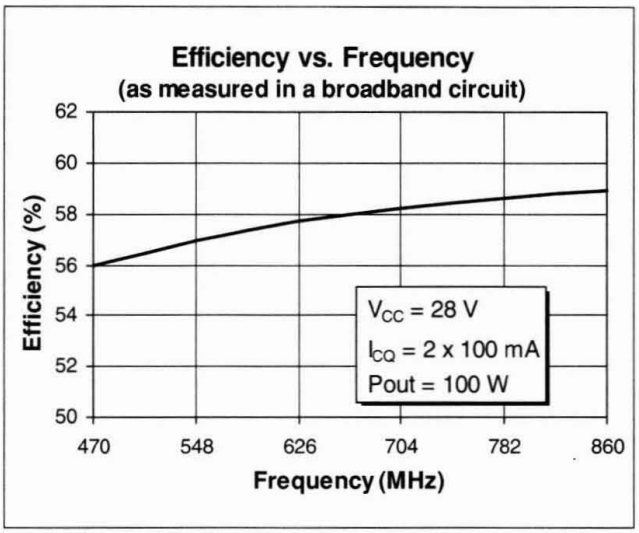
(V_{CC} = 28 Vdc, P_{OUT} = 100 W, I_{CQ} = 2 x 100 mA)

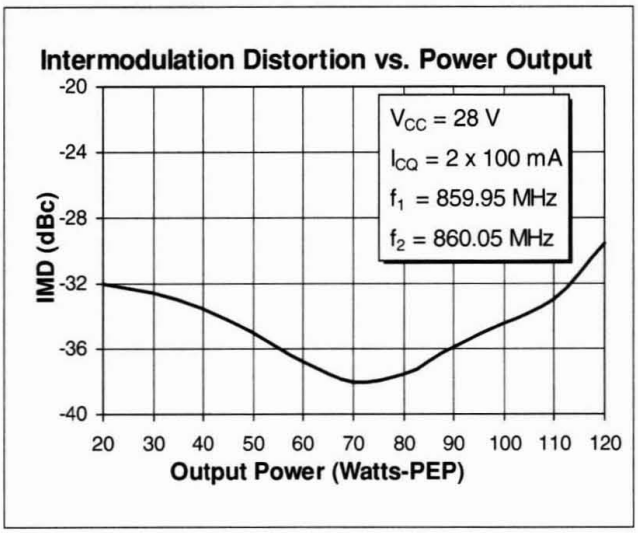


Frequency	Z Source Ω		Z Load Ω	
MHz	R	jX	R	jX
470	2.0	-3.6	9.8	-9.8
650	3.6	-7.0	9.0	-1.3
860	6.0	-13.5	4.5	-5.0



Typical Performance





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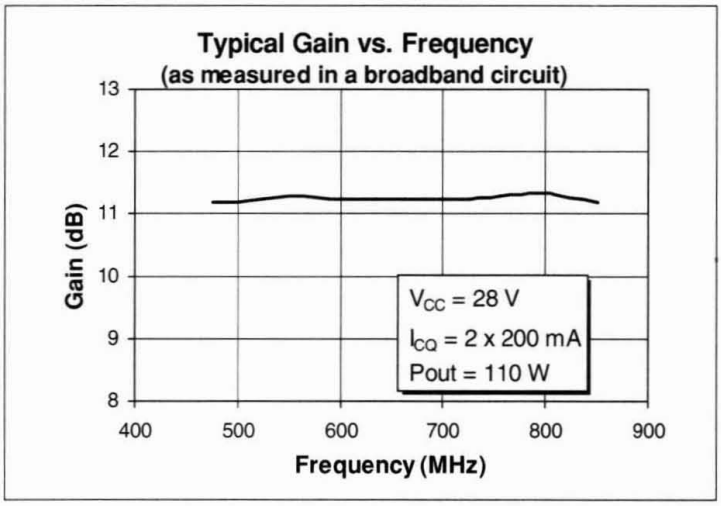
ERICSSON

PTB 20101
175 Watts P-Sync, 470–860 MHz
UHF TV Power Transistor

Description

The PTB 20101 is a class AB, NPN, common emitter UHF TV power transistor intended for 28 Vdc operation from 470 to 860 MHz. It is rated at 175 watts P-sync minimum output power. Ion implantation, nitride surface passivation and gold metallization are used to ensure excellent device reliability. 100% lot traceability is standard.

- 28 Volt, 860 MHz Characteristics
  - Output Power = 175 Watts P-Sync
  - Output Power = 110 (CW)
  - Gain = 10.0 dB Min
- 55% Collector Efficiency at 110 Watts
- Class AB Characteristics
- Gold Metallization
- Silicon Nitride Passivated



Package 20224

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Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage (1)	V_{CER}	40	Vdc
Collector-Base Voltage (1)	V_{CBO}	65	Vdc
Emitter-Base Voltage (collector open)	V_{EBO}	4.0	Vdc
Collector Current (continuous)	I_C	20	Adc
Total Device Dissipation at T_{flange} = 25°C Above 25°C derate by	P_D	330 1.89	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{flange} = 70°C)	$R_{\theta JC}$	0.53	°C/W

(1)per side

Electrical Characteristics (100% Tested—characteristics, conditions and limits shown per side)

Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Breakdown Voltage C to E	I_B = 0 A, I_C = 100 mA	$V_{(BR)CEO}$	25	30	—	Volts
Breakdown Voltage C to E	V_{BE} = 0 V, I_C = 100 mA	$V_{(BR)CES}$	55	70	—	Volts
Breakdown Voltage E to B	I_C = 0 A, I_E = 5 mA	$V_{(BR)EBO}$	3.5	5	—	Volts
DC Current Gain	V_{CE} = 5 V, I_C = 1 A	h_{FE}	20	50	100	—
Output Capacitance (per side)	V_{CB} = 28 V, I_E = 0 A, f = 1 MHz	C_{ob}	—	85	—	pF

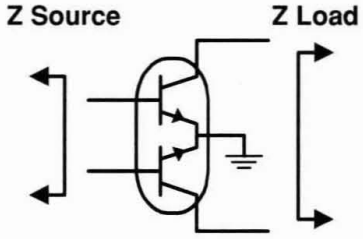
RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Output Power (P-Sync) (V_{CC} = 28 Vdc, I_{CQ} = 200 mA per side, f = 860 MHz)	P_{OUT}	175	—	—	Watts
Gain (V_{CC} = 28 Vdc, P_{OUT} = 110 W, I_{CQ} = 200 mA per side, f = 860 MHz)	G_{pe}	10.0	11	—	dB
Collector Efficiency (V_{CC} = 28 Vdc, P_{OUT} = 110 W, I_{CQ} = 200 mA per side, f = 860 MHz)	η_C	55	58	—	%
Load Mismatch Tolerance (V_{CC} = 28 Vdc, P_{OUT} = 175 W, I_{CQ} = 200 mA per side, f = 860 MHz—all phase angles at frequency of test)	Ψ	—	—	5:1	—

3

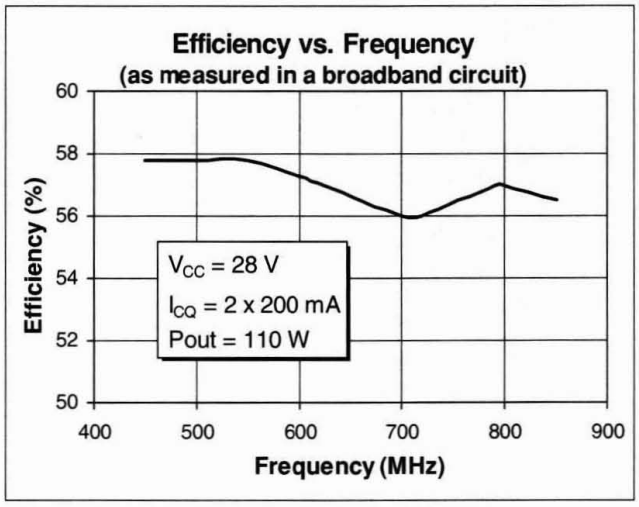
Impedance Data (data shown for fixed-tuned broadband circuit)

(V_{CC} = 28 Vdc, P_{OUT} = 110 W, I_{CQ} = 200 mA per side)



Frequency	Z Source Ω		Z Load Ω	
MHz	R	jX	R	jX
450	0.4	-1.0	2.0	0.3
550	0.5	-1.3	1.6	0.0
650	0.7	-1.8	1.3	0.0
750	1.8	-2.0	1.0	-0.8
850	2.7	-0.5	0.9	-1.2

Typical Performance



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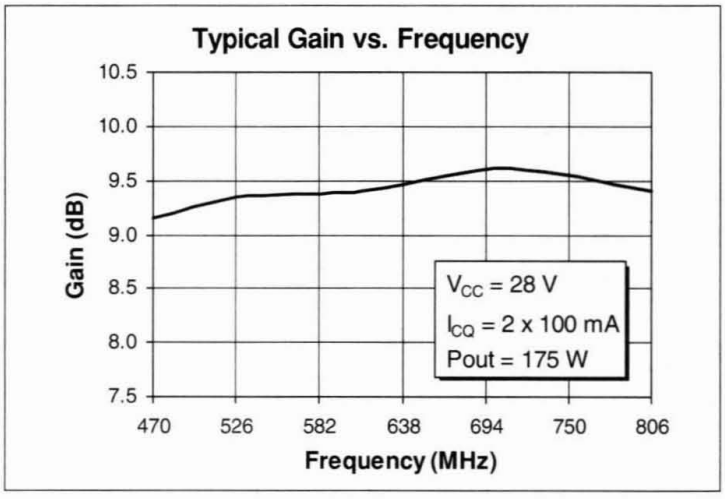
ERICSSON

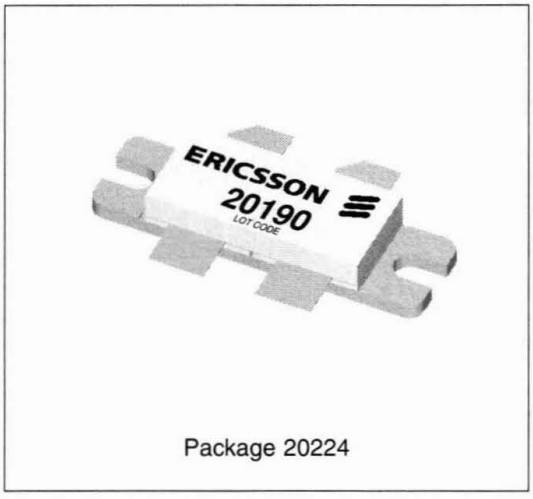
PTB 20190
175 Watts, 470–806 MHz
Digital Television Power Transistor

Description

The PTB 20190 is a class AB, NPN, common emitter RF power transistor intended for 28 Vdc operation across the 470 to 806 MHz UHF TV frequency band. Rated at 175 watts output power, it is specifically intended to operate uncorrected at 125 watts P-Sync (tested to EIA Standard 4.1.3, Section 5, Method B for class AB transmitters at 125 watts P-sync) or at a minimum of 175 watts in PEP applications. It may also be operated at comparable power levels for ATV broadcasting. Ion implantation, nitride surface passivation and gold metallization ensure excellent device reliability. 100% lot traceability is standard.

- 175 Watts, 470–806 MHz
- Class AB Characteristics
- 50% Collector Efficiency at 175 Watts
- Gold Metallization
- Silicon Nitride Passivated





Package 20224

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Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage (1)	V_{CER}	40	Vdc
Collector-Base Voltage (1)	V_{CBO}	60	Vdc
Emitter-Base Voltage (collector open)	V_{EBO}	4.0	Vdc
Collector Current (continuous)	I_C	25.0	Adc
Total Device Dissipation at T_{flange} = 25°C Above 25°C derate by	P_D	330 1.89	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{flange} = 70°C)	$R_{\theta JC}$	0.53	°C/W

(1)per side

PTB 20190

ERICSSON

Electrical Characteristics (100% Tested—characteristics, conditions and limits shown per side)

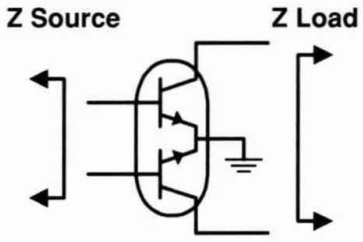
Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Breakdown Voltage C to E	I_B = 0 A, I_C = 100 mA	$V_{(BR)CEO}$	25	30	—	Volts
Breakdown Voltage C to E	V_{BE} = 0 V, I_C = 100 mA	$V_{(BR)CES}$	55	60	—	Volts
Breakdown Voltage E to B	I_C = 0 A, I_E = 5 mA	$V_{(BR)EBO}$	3.5	5	—	Volts
DC Current Gain	V_{CE} = 5 V, I_C = 1.0 A	h_{FE}	20	50	100	—

RF Specifications (100% Tested)

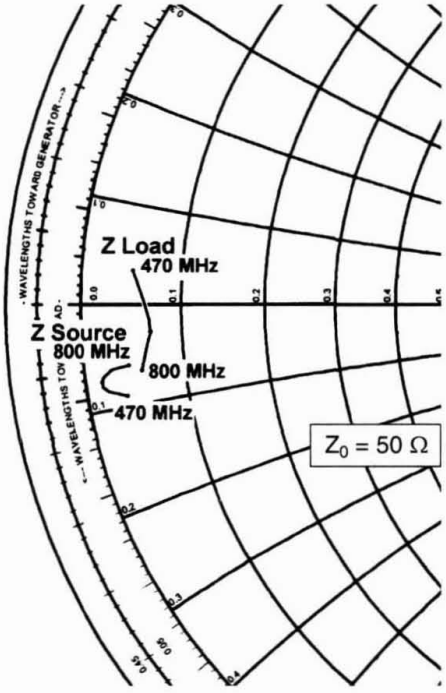
Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{CC} = 28 Vdc, P_{OUT} = 50 W, I_{CQ} = 2 x 100 mA, f = 800 MHz)	G_{pe}	8.0	9.5	—	dB
Collector Efficiency (V_{CC} = 28 Vdc, P_{OUT} = 125 W, I_{CQ} = 2 x 100 mA, f = 800 MHz)	η_C	—	45	—	%
Intermodulation Distortion (Two Tone) (V_{CC} = 28 Vdc, P_{OUT} = 125 W(PEP), I_{CQ} = 2 x 100 mA, f = 800 MHz, Δf = 1.0 MHz)	IMD	—	40	—	dBc
In-Channel Intermodulation Distortion (P-Sync = 125 W + Aural, EIA Std 4.1.3 Sect 5 Method B)	IM Product +/- 920 kHz	—	-52	—	dB P-sync
Load Mismatch Tolerance (V_{CC} = 28 Vdc, P_{OUT} = 125 W(PEP), I_{CQ} = 2 x 100 mA, f = 800 MHz—all phase angles at frequency of test)	Ψ	—	—	3:1	—

Impedance Data

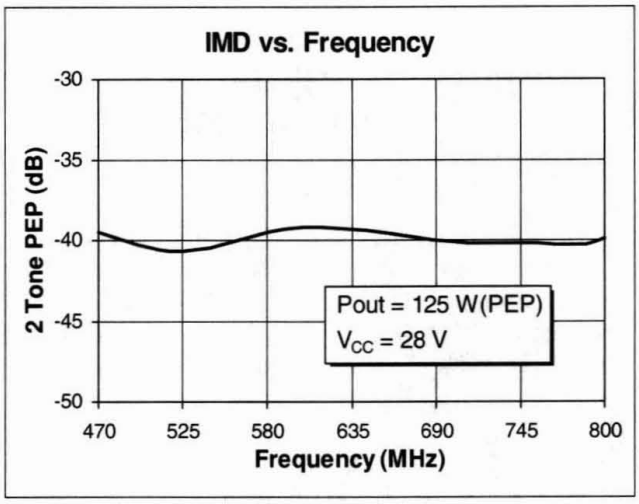
V_{CC} = 28 Vdc, P_{OUT} = 175 W, I_{CQ} = 2 x 100 mA



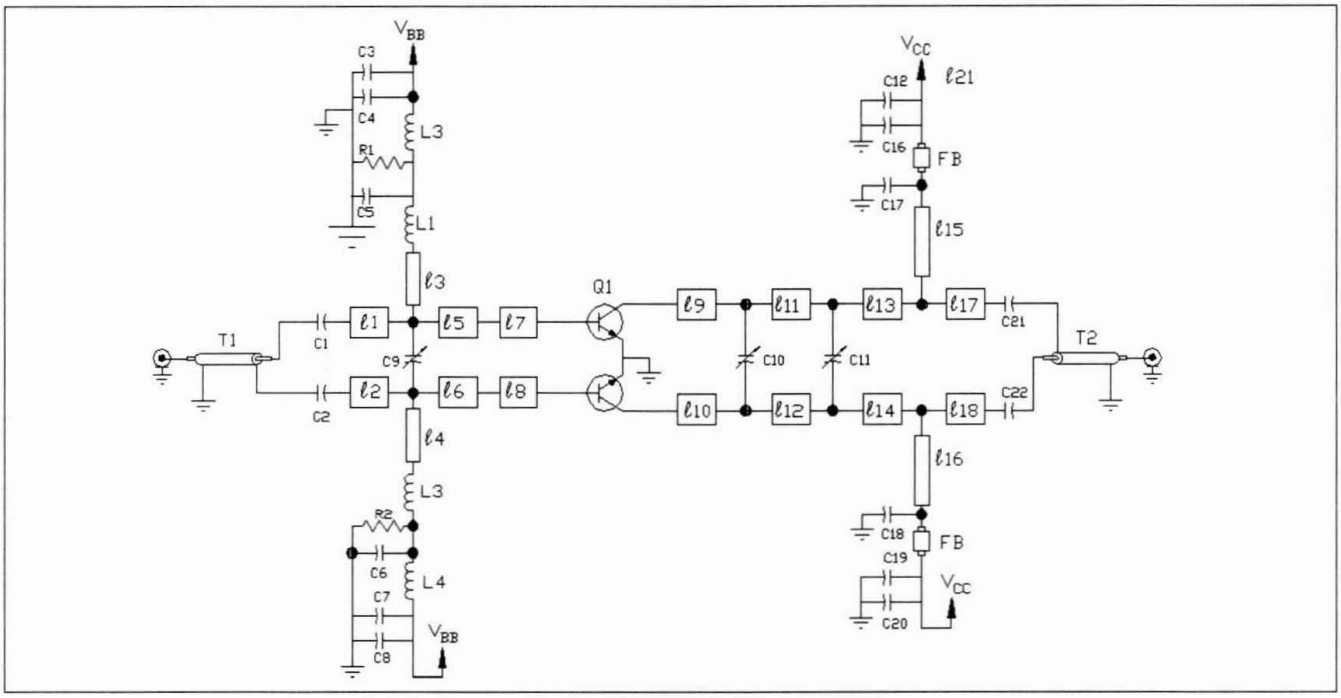
Frequency	Z Source Ω		Z Load Ω	
MHz	R	jX	R	jX
470	1.87	-4.1	2.42	1.74
630	0.76	-3.9	3.34	-1.49
800	2.12	-3.8	2.72	-3.36



Typical Characteristics



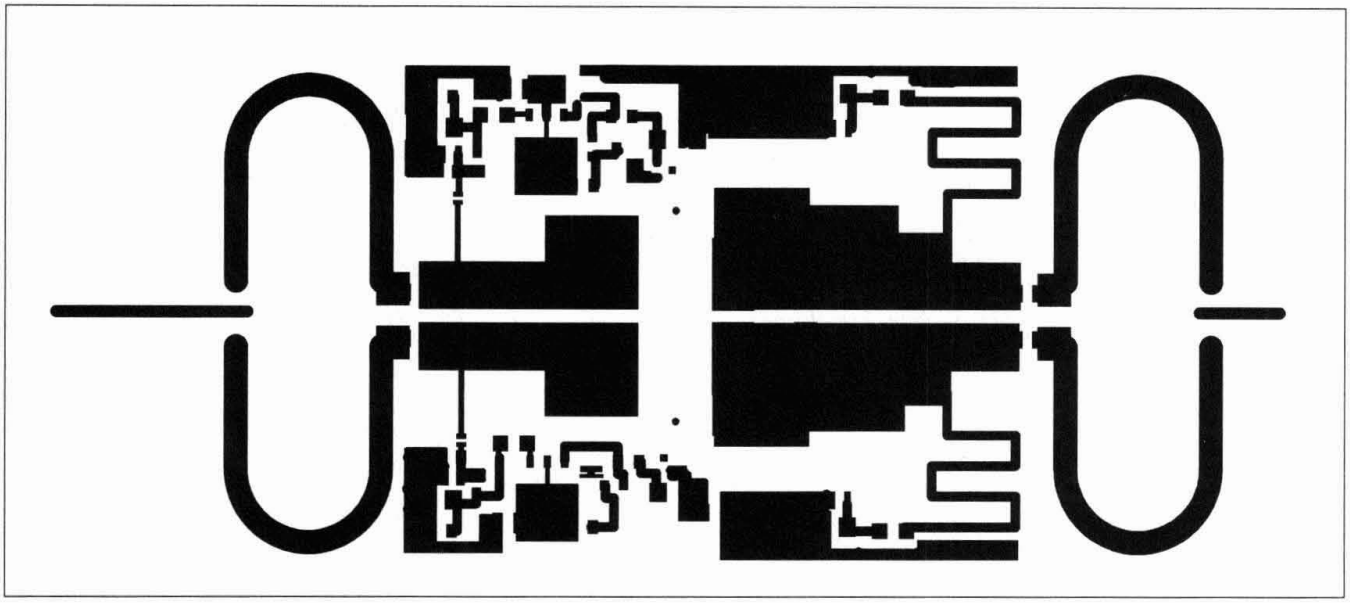
Test Circuit



Block Diagram for f = 800 MHz

Q1	PTB 20190	NPN RF Transistor
ℓ1, ℓ2	.0280 λ 800 MHz	Microstrip 18.5 Ω
ℓ5, ℓ6	.0522 λ 800 MHz	Microstrip 18.5 Ω
ℓ3, ℓ4	.0654 λ 800 MHz	Microstrip 70 Ω
ℓ7, ℓ8	.0632 λ 800 MHz	Microstrip 10.2 Ω
ℓ9, ℓ10	.0652 λ 800 MHz	Microstrip 8 Ω
ℓ11, ℓ12	.0652 λ 800 MHz	Microstrip 9 Ω
ℓ13, ℓ14	.0300 λ 800 MHz	Microstrip 11.5 Ω
ℓ15, ℓ16	.0250 λ 800 MHz	Microstrip 60 Ω
ℓ17, ℓ18	.0454 λ 800 MHz	Microstrip 18.5 Ω
T1, T2	UT85-25	Balun

C1, C2	5.1 pF	
C3, C12, C8, C20	10 µF, 35 V	SMT Capacitor
C4, C7, C19, C16		0.1 µF
C5, C6, C17, C18, C21, C22		75 pF
C9, C10		0-10 pF
C11		0-20 pF
R1, R2		15 Ω, 1/4 W
FB	4 mm.	SMT Ferrite
L1, L3	12 nh	SMT Inductor
L2, L4	68 nh	SMT Inductor
Circuit Board	.028" Dielectric Thickness, ε_r = 4.0, AlliedSignal, G200, 2 oz. Copper	



Artwork (1 inch ——— *)*

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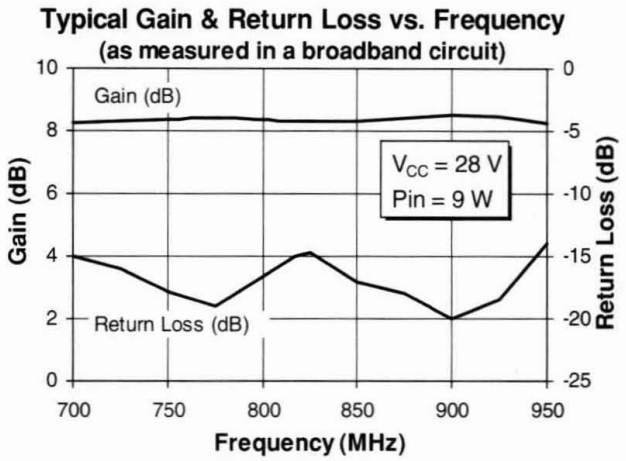
ERICSSON

PTB 20155
9 Watts, 610–960 MHz
UHF Power Transistor

Description

The PTB 20155 is an NPN common base RF power transistor intended for 28 Vdc class C operation from 610 to 960 MHz. Rated at 9 watts minimum output power, it may be used for both CW and PEP applications. Ion implantation, nitride surface passivation and gold metallization are used to ensure excellent device reliability. 100% lot traceability is standard.

- 9 Watts, 610–960 MHz
- Class C Characteristics
- Gold Metallization
- Silicon Nitride Passivated



Package 20209

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CER}	40	Vdc
Collector-Base Voltage	V_{CBO}	50	Vdc
Emitter-Base Voltage (collector open)	V_{EBO}	4	Vdc
Collector Current (continuous)	I_C	6.7	Adc
Total Device Dissipation at T_{flange} = 25°C Above 25°C derate by	P_D	65 0.37	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{flange} = 70°C)	$R_{\theta JC}$	2.7	°C/W

Electrical Characteristics (100% Tested)

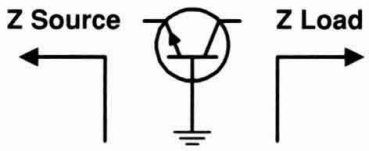
Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Breakdown Voltage C to E	V_{BE} = 0 V, I_C = 5 mA	$V_{(BR)CES}$	50	—	—	Volts
Breakdown Voltage E to B	I_C = 0 A, I_E = 5 mA	$V_{(BR)EBO}$	3.5	—	—	Volts
DC Current Gain	V_{CE} = 5 V, I_C = 300 mA	h_{FE}	25	—	100	—
Output Capacitance	V_{CB} = 28 V, I_E = 0 A, f = 1 MHz	C_{ob}	—	10.5	11	pF
Collector Cut-off Current	V_{CB} = 28 V, I_E = 0 A	I_{CBO}	—	—	1.5	mA

RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{CC} = 28 Vdc, P_{OUT} = 9 W, f = 960 MHz)	G_{pe}	8.0	9.0	—	dB
Collector Efficiency (V_{CC} = 28 Vdc, P_{OUT} = 9 W, f = 960 MHz)	η_C	45	53	—	%

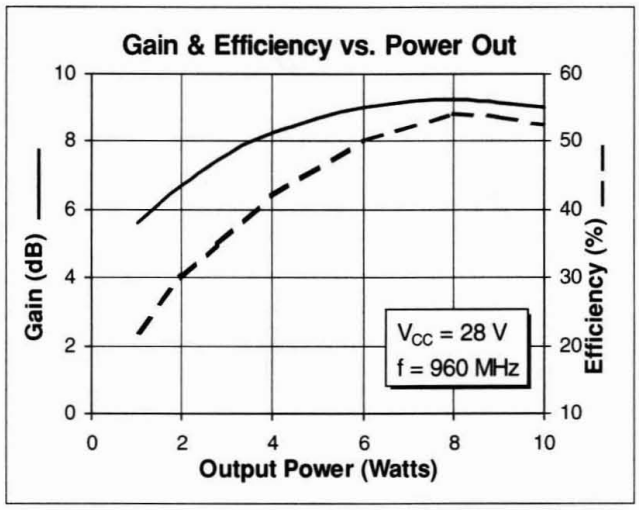
Impedance Data (data shown for fixed-tuned broadband circuit)

(V_{CC} = 28 Vdc, P_{OUT} = 9 W)



Frequency	Z Source Ω		Z Load Ω	
MHz	R	jX	R	jX
850	4.4	-10.7	8.6	3.6
900	6.4	-10.0	9.3	4.9
960	6.4	-14.3	7.8	3.1

Typical Performance



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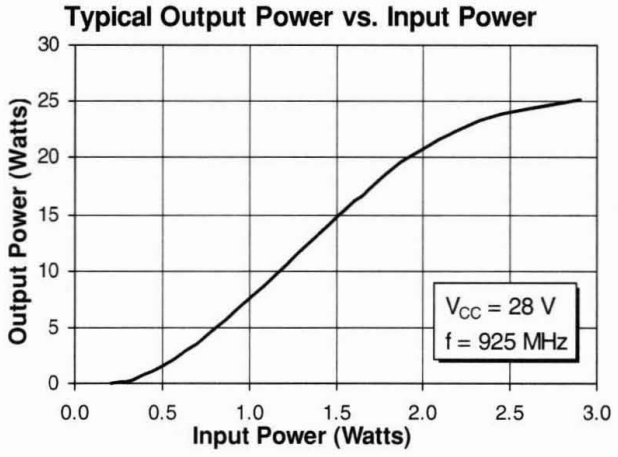
ERICSSON

PTB 20166
23 Watts, 675–925 MHz
Common Base RF Power Transistor

Description

The PTB 20166 is an NPN, common base RF power transistor intended for 24–30 Vdc class C operation from 675 to 925 MHz. Rated at 23 watts minimum output power, it may be used for both CW and pulsed applications. Ion implantation, nitride surface passivation and gold metallization are used to ensure excellent device reliability. 100% lot traceability is standard.

- Specified at 28 Volt, 925 MHz
- Class C Characteristics
- 55% Min Collector Efficiency at 23 Watts
- Gold Metallization
- Silicon Nitride Passivated



Package 20209

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CER}	50	Vdc
Collector-Base Voltage	V_{CBO}	50	Vdc
Emitter-Base Voltage (collector open)	V_{EBO}	4	Vdc
Collector Current (continuous)	I_C	4	Adc
Total Device Dissipation at T_{flange} = 25°C Above 25°C derate by	P_D	48 0.27	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{flange} = 70°C)	$R_{\theta JC}$	3.6	°C/W

Electrical Characteristics (100% Tested)

Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Breakdown Voltage C to E	I_C = 50 mA, R_{BE} = 27 Ω	$V_{(BR)CER}$	50	—	—	Volts
Breakdown Voltage C to E	V_{BE} = 0 V, I_C = 50 mA	$V_{(BR)CES}$	50	—	—	Volts
Breakdown Voltage E to B	I_C = 0 A, I_E = 5 mA	$V_{(BR)EBO}$	4	—	—	Volts
DC Current Gain	V_{CE} = 5 V, I_C = 500 mA	h_{FE}	30	50	100	—

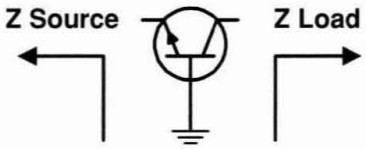
RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{CC} = 28 Vdc, P_{OUT} = 23 W, f = 925 MHz)	G_{pe}	8	9	—	dB
Collector Efficiency (V_{CC} = 28 Vdc, P_{OUT} = 23 W, f = 925 MHz)	η_C	55	65	—	%
Load Mismatch Tolerance (V_{CC} = 28 Vdc, P_{OUT} = 23 W, f = 925 MHz —all phase angles at frequency of test)	Ψ	—	—	5:1	—

Impedance Data (data shown for fixed-tuned broadband circuit)

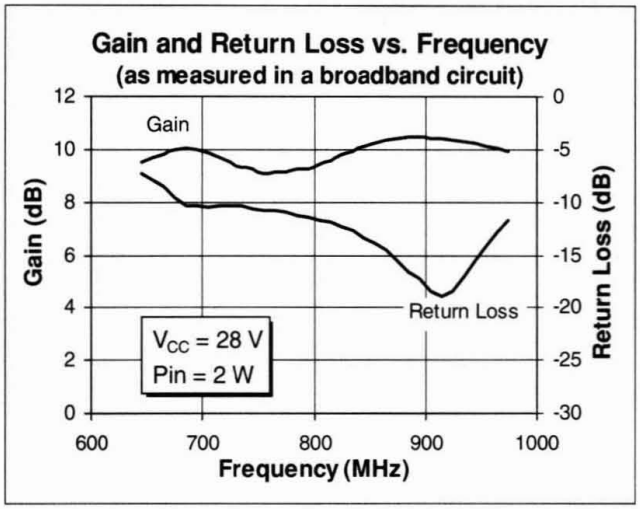
3

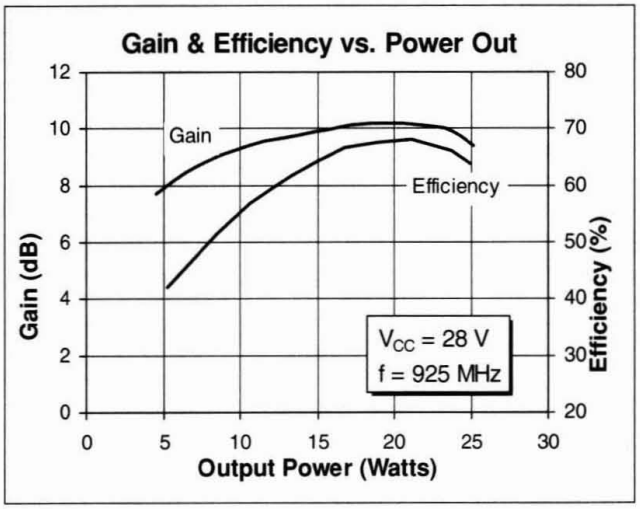
(V_{CC} = 28 Vdc, P_{OUT} = 23 W)



Frequency	Z Source Ω		Z Load Ω	
MHz	R	jX	R	jX
675	7.4	-1.8	6.6	9.0
700	7.2	-1.4	7.2	8.6
725	7.0	-1.1	7.5	8.1
750	6.9	-0.79	7.6	7.6
775	6.6	-0.52	7.6	7.1
800	6.4	-0.26	7.5	6.7
825	6.1	0.01	7.2	6.4
850	5.7	0.29	6.9	6.2
875	5.3	0.62	6.6	6.1
900	4.9	1.0	6.2	6.0
925	4.5	1.4	5.9	6.1

Typical Performance





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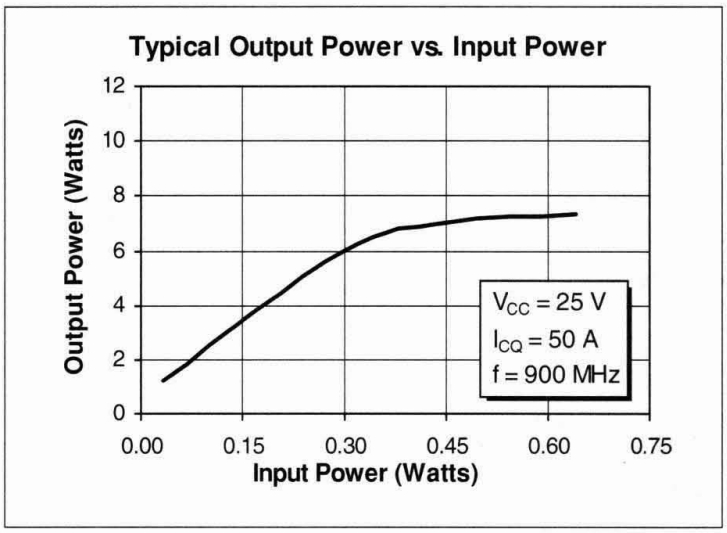
ERICSSON

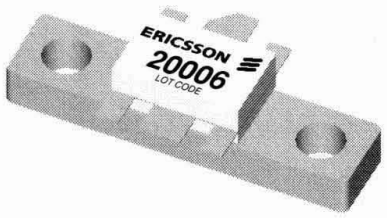
PTB 20006
4 Watts, 860–900 MHz
Cellular Radio RF Power Transistor

Description

The PTB 20006 is a class AB, NPN, common emitter RF power transistor intended for 25 Vdc operation across the 860 to 900 MHz frequency band. Rated at 4 watts minimum output power, it may be used for both CW and PEP applications. Ion implantation, nitride surface passivation and gold metallization are used to ensure excellent device reliability. 100% lot traceability is standard.

- 4 Watts, 860–900 MHz
- Class AB Characteristics
- 50% Collector Efficiency at 4 Watts
- Gold Metallization
- Silicon Nitride Passivated





Package 20201

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CER}	40	Vdc
Collector-Base Voltage	V_{CBO}	50	Vdc
Emitter-Base Voltage (collector open)	V_{EBO}	4.0	Vdc
Collector Current (continuous)	I_C	1.7	Adc
Total Device Dissipation at T_{flange} = 25°C Above 25°C derate by	P_D	35 0.2	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{flange} = 70°C)	$R_{\theta JC}$	5.0	°C/W

Electrical Characteristics (100% Tested)

Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Breakdown Voltage C to E	I_B = 0 A, I_C = 50 mA	$V_{(BR)CEO}$	25	30	—	Volts
Breakdown Voltage C to E	V_{BE} = 0 V, I_C = 50 mA	$V_{(BR)CES}$	55	70	—	Volts
Breakdown Voltage E to B	I_C = 0 A, I_E = 5 mA	$V_{(BR)EBO}$	3.5	5	—	Volts
DC Current Gain	V_{CE} = 5 V, I_C = 250 mA	h_{FE}	20	50	120	—

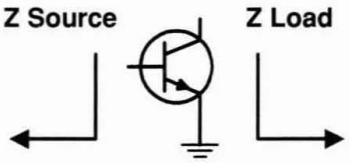
RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{CC} = 25 Vdc, P_{OUT} = 4 W, I_{CQ} = 50 mA, f = 860 MHz)	G_{pe}	11.0	13.0	—	dB
Collector Efficiency (V_{CC} = 25 Vdc, P_{OUT} = 4 W, I_{CQ} = 50 mA, f = 860 MHz)	η_C	45	—	—	%
Intermodulation Distortion (V_{CC} = 25 Vdc, P_{OUT} = 4 W(PEP), I_{CQ} = 50 mA, f_1 = 860MHz, f_2 = 861 MHz)	IMD	—	-25	—	dBc
Load Mismatch Tolerance (V_{CC} = 25 Vdc, P_{OUT} = 4 W, I_{CQ} = 50 mA, f = 860 MHz —all phase angles at frequency of test)	Ψ	—	—	30:1	—

3

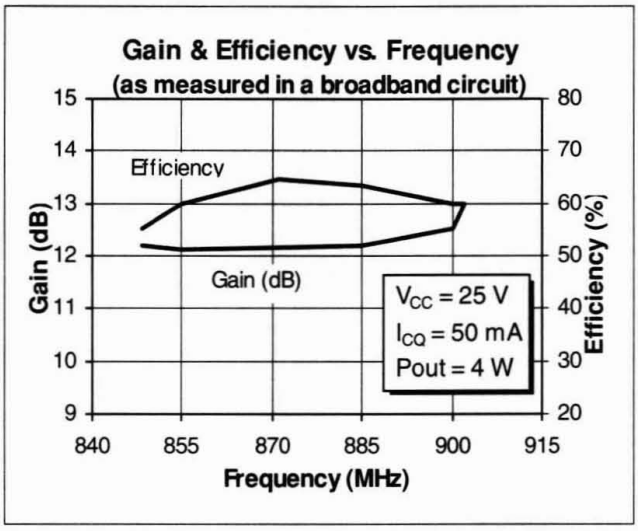
Impedance Data (data shown for fixed-tuned broadband circuit)

(V_{CC} = 25 Vdc, P_{OUT} = 4 W, I_{CQ} = 50 mA)



Frequency	Z Source Ω		Z Load Ω	
MHz	R	jX	R	jX
860	5.3	-5.5	2.4	11.0
880	5.0	-5.0	2.3	11.6
900	4.9	-4.4	2.1	12.0

Typical Performance



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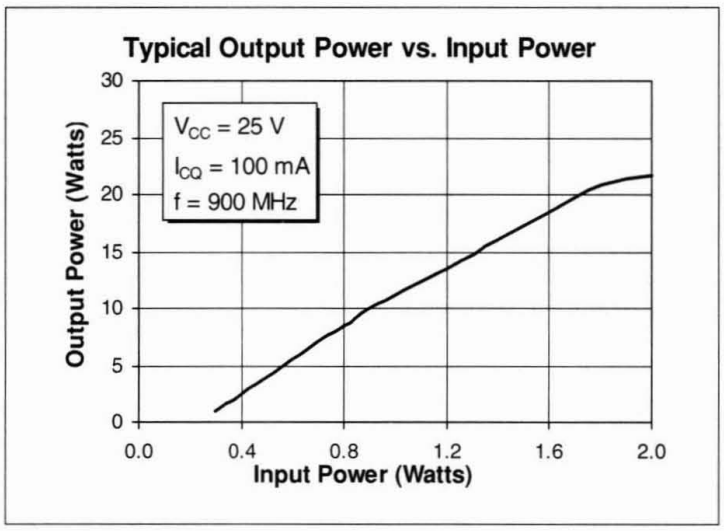
ERICSSON

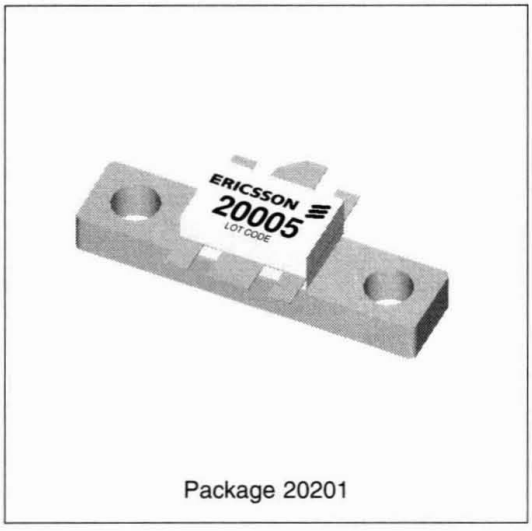
PTB 20005
15 Watts, 860–900 MHz
Cellular Radio RF Power Transistor

Description

The PTB 20005 is a class AB, NPN, common emitter RF power transistor intended for 25 Vdc operation across the 860 to 900 MHz frequency band. Rated at 15 watts minimum output power, it may be used for both CW and PEP applications. Ion implantation, nitride surface passivation and gold metallization are used to ensure excellent device reliability. 100% lot traceability is standard.

- 15 Watts, 860–900 MHz
- Class AB Characteristics
- 50% Collector Efficiency at 15 Watts
- Gold Metallization
- Silicon Nitride Passivated





Package 20201

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CER}	40	Vdc
Collector-Base Voltage	V_{CBO}	50	Vdc
Emitter-Base Voltage (collector open)	V_{EBO}	4.0	Vdc
Collector Current (continuous)	I_C	6.7	Adc
Total Device Dissipation at T_{flange} = 25°C Above 25°C derate by	P_D	65 0.4	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{flange} = 70°C)	$R_{\theta JC}$	2.7	°C/W

PTB 20005

ERICSSON

Electrical Characteristics (100% Tested)

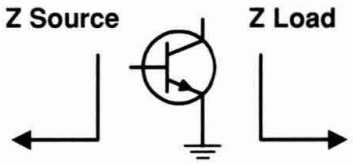
Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Breakdown Voltage C to E	I_B = 0 A, I_C = 100 mA	$V_{(BR)CEO}$	25	30	—	Volts
Breakdown Voltage C to E	V_{BE} = 0 V, I_C = 100 mA	$V_{(BR)CES}$	55	70	—	Volts
Breakdown Voltage E to B	I_C = 0 A, I_E = 5 mA	$V_{(BR)EBO}$	3.5	5	—	Volts
DC Current Gain	V_{CE} = 5 V, I_C = 1 A	h_{FE}	20	50	100	—

RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{CC} = 25 Vdc, P_{OUT} = 15 W, I_{CQ} = 100 mA, f = 900 MHz)	G_{pe}	9.0	11.0	—	dB
Collector Efficiency (V_{CC} = 25 Vdc, P_{OUT} = 15 W, I_{CQ} = 100 mA, f = 900 MHz)	η_C	50	—	—	%
Intermodulation Distortion (V_{CC} = 25 Vdc, P_{OUT} = 15 W(PEP), I_{CQ} = 100 mA, f_1 = 860 MHz, f_2 = 861 MHz)	IMD	—	-32	—	dBc
Load Mismatch Tolerance (V_{CC} = 25 Vdc, P_{OUT} = 15 W, I_{CQ} = 100 mA, f = 900 MHz —all phase angles at frequency of test)	Ψ	—	—	30:1	—

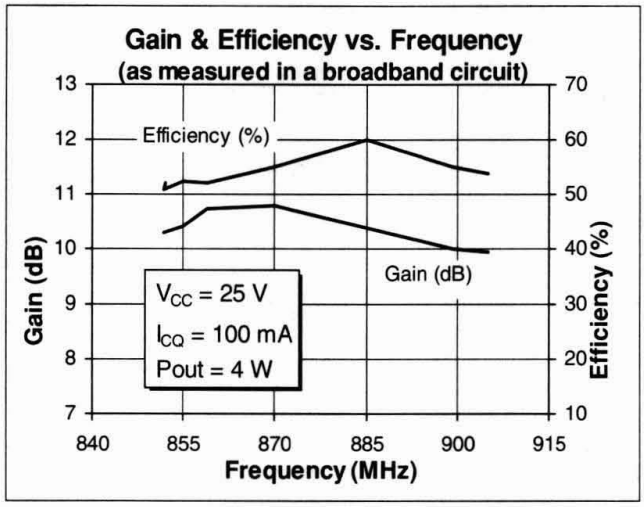
Impedance Data (data shown for fixed-tuned broadband circuit)

(V_{CC} = 25 Vdc, P_{OUT} = 15 W, I_{CQ} = 100 m)



Frequency	Z Source Ω		Z Load Ω	
MHz	R	jX	R	jX
860	2.9	-5.6	2.0	-1.5
880	2.7	-5.0	1.9	-1.3
900	2.5	-4.5	1.8	-1.0

Typical Performance



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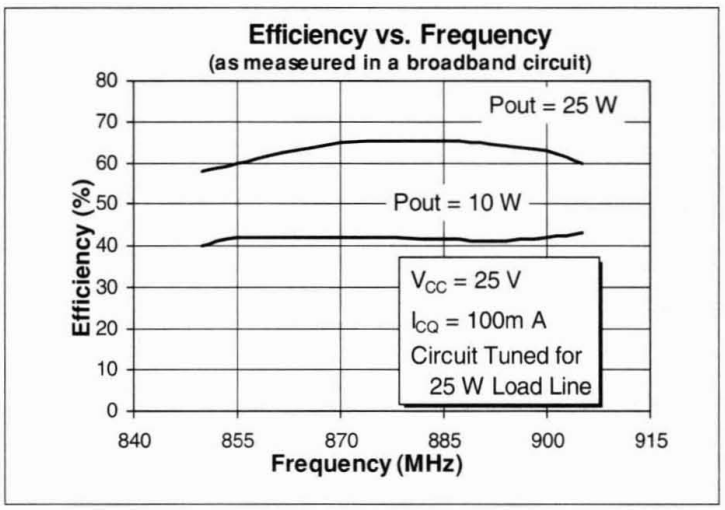
ERICSSON

PTB 20038
25 Watts, 860–900 MHz
Cellular Radio RF Power Transistor

Description

The PTB 20038 is a class AB, NPN, common emitter RF power transistor intended for 25 Vdc operation across the 860 to 900 MHz frequency band. Rated at 25 watts minimum output power, it may be used for both CW and PEP applications. It is specifically designed for high efficiency operation at average power levels around 10 watts with high PEP capacity. Ion implantation, nitride surface passivation and gold metallization are used to ensure excellent device reliability. 100% lot traceability is standard.

- 25 Watts, 860–900 MHz
- Class AB Characteristics
- Gold Metallization
- Silicon Nitride Passivated



Package 20200

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CER}	40	Vdc
Collector-Base Voltage	V_{CBO}	50	Vdc
Emitter-Base Voltage (collector open)	V_{EBO}	4.0	Vdc
Collector Current (continuous)	I_C	6.7	Adc
Total Device Dissipation at T_{flange} = 25°C Above 25°C derate by	P_D	65 0.37	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{flange} = 70°C)	$R_{\theta JC}$	2.7	°C/W

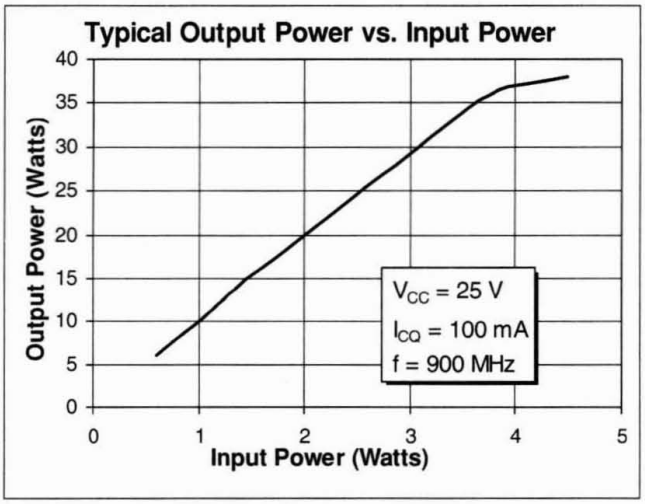
Electrical Characteristics (100% Tested)

Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Breakdown Voltage C to E	I_B = 0 A, I_C = 100 mA	$V_{(BR)CEO}$	25	30	—	Volts
Breakdown Voltage C to E	V_{BE} = 0 V, I_C = 100 mA	$V_{(BR)CES}$	55	70	—	Volts
Breakdown Voltage E to B	I_C = 0 A, I_E = 5 mA	$V_{(BR)EBO}$	3.5	5	—	Volts
DC Current Gain	V_{CE} = 5 V, I_C = 1 A	h_{FE}	20	50	100	—

RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{CC} = 25 Vdc, P_{OUT} = 25 W, I_{CQ} = 100 mA, f = 900 MHz)	G_{pe}	9.0	10.0	—	dB
Collector Efficiency (V_{CC} = 25 Vdc, P_{OUT} = 25 W, I_{CQ} = 100 mA, f = 900 MHz)	η_C	50	—	—	%
Gain (V_{CC} = 25 Vdc, P_{OUT} = 10 W, I_{CQ} = 100 mA, f = 900 MHz)	G_{pe}	10	11	—	dB
Collector Efficiency (V_{CC} = 25 Vdc, P_{OUT} = 10 W, I_{CQ} = 100 mA, f = 900 MHz)	η_C	35	—	—	%
Load Mismatch Tolerance (V_{CC} = 25 Vdc, P_{OUT} = 10 W, I_{CQ} = 100 mA, f = 900 MHz—all phase angles at frequency of test)	Ψ	—	—	30:1	—

Typical Performance



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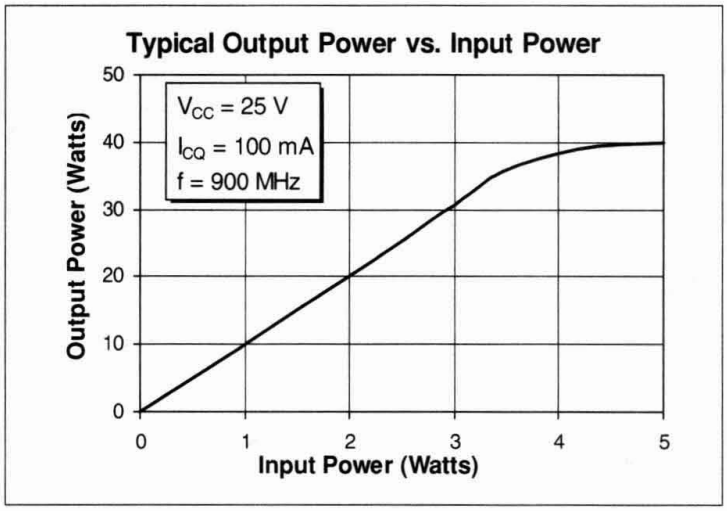
ERICSSON

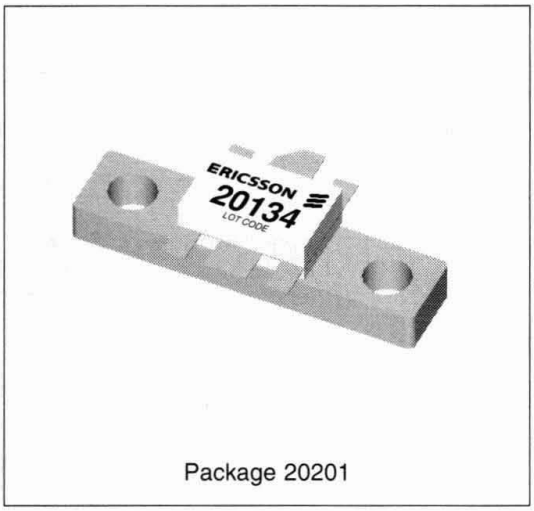
PTB 20134
30 Watts, 860–900 MHz
Cellular Radio RF Power Transistor

Description

The PTB 20134 is a class AB, NPN, common emitter RF power transistor intended for 25 Vdc operation from 860 to 900 MHz. Rated at 30 watts minimum output power, it may be used for both CW and PEP applications. Ion implantation, nitride surface passivation and gold metallization are used to ensure excellent device reliability. 100% lot traceability is standard.

- 30 Watts, 860–900 MHz
- Class AB Characteristics
- 50% Min Collector Efficiency at 30 Watts
- Gold Metallization
- Silicon Nitride Passivated





Package 20201

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CER}	40	Vdc
Collector-Base Voltage	V_{CBO}	50	Vdc
Emitter-Base Voltage (collector open)	V_{EBO}	4.0	Vdc
Collector Current (continuous)	I_C	8.0	Adc
Total Device Dissipation at T_{flange} = 25°C Above 25°C derate by	P_D	80 0.45	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{flange} = 70°C)	$R_{\theta JC}$	2.2	°C/W

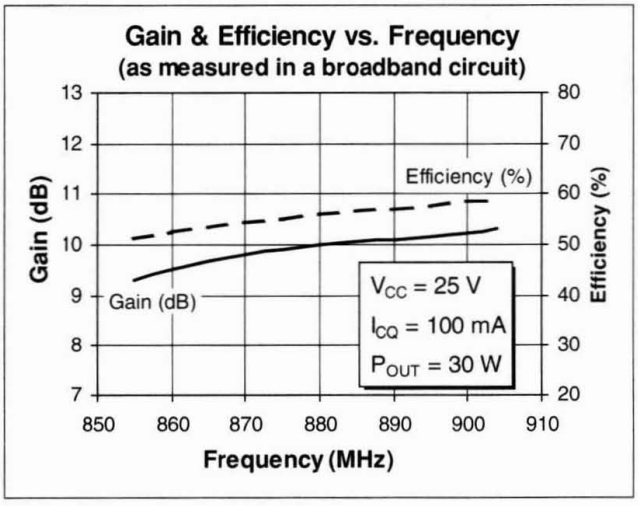
Electrical Characteristics (100% Tested)

Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Breakdown Voltage C to E	I_B = 0 A, I_C = 100 mA	$V_{(BR)CEO}$	25	30	—	Volts
Breakdown Voltage C to E	V_{BE} = 0 V, I_C = 100 mA	$V_{(BR)CES}$	55	70	—	Volts
Breakdown Voltage E to B	I_C = 0 A, I_E = 5 mA	$V_{(BR)EBO}$	3.5	5	—	Volts
DC Current Gain	V_{CE} = 5 V, I_C = 1 A	h_{FE}	20	50	100	—

RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{CC} = 25 Vdc, P_{OUT} = 30 W, I_{CQ} = 100 mA, f = 900 MHz)	G_{pe}	8	9.5	—	dB
Collector Efficiency (V_{CC} = 25 Vdc, P_{OUT} = 30 W, I_{CQ} = 100 mA, f = 900 MHz)	η_C	50	—	—	%
Intermodulation Distortion (V_{CC} = 25 Vdc, P_{OUT} = 30 W(PEP), I_{CQ} = 100 mA, f = 900 MHz, Δf = 1 MHz)	IMD	—	-30	—	dBc
Load Mismatch Tolerance (V_{CC} = 25 Vdc, P_{OUT} = 30 W, I_{CQ} = 100 mA, f = 900 MHz—all phase angles at frequency of test)	Ψ	—	—	30:1	—

Typical Performance



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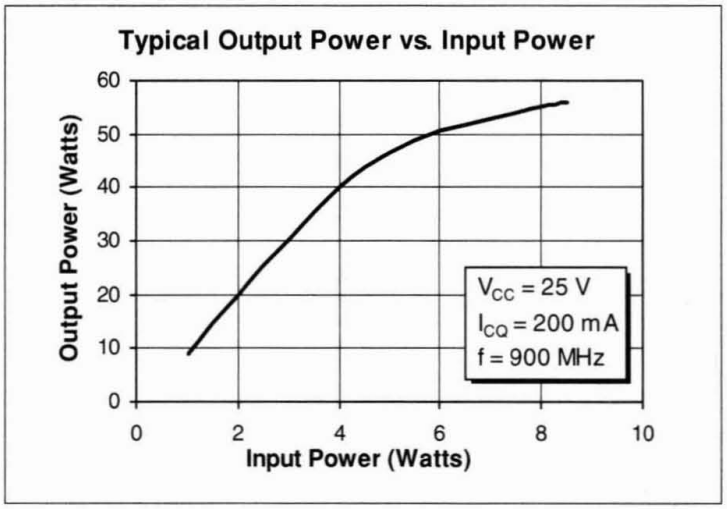
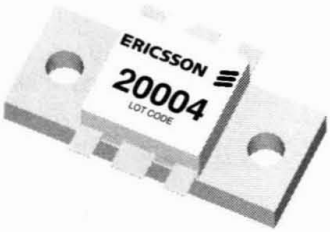
PTB 20004
50 Watts, 860–900 MHz
Cellular Radio RF Power Transistor

Description

The PTB 20004 is a class AB, NPN, common emitter RF power transistor intended for 25 Vdc operation across the 860 to 900 MHz frequency band. Rated at 50 watts minimum output power, it may be used for both CW and PEP applications. Ion implantation, nitride surface passivation and gold metallization are used to ensure excellent device reliability. 100% lot traceability is standard.

- 50 Watts, 860–900 MHz
- Class AB Characteristics
- 50% Collector Efficiency at 50 Watts
- Gold Metallization
- Silicon Nitride Passivated





Package 20200

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CER}	40	Vdc
Collector-Base Voltage	V_{CBO}	50	Vdc
Emitter-Base Voltage (collector open)	V_{EBO}	4.0	Vdc
Collector Current (continuous)	I_C	10.0	Adc
Total Device Dissipation at T_{flange} = 25°C Above 25°C derate by	P_D	175 1.0	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{flange} = 70°C)	$R_{\theta JC}$	1.0	°C/W

PTB 20004

ERICSSON

Electrical Characteristics (100% Tested)

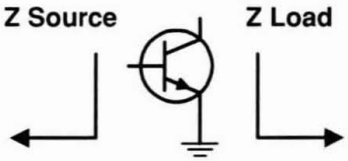
Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Breakdown Voltage C to E	I_B = 0 A, I_C = 100 mA	$V_{(BR)CEO}$	25	30	—	Volts
Breakdown Voltage C to E	V_{BE} = 0 V, I_C = 100 mA	$V_{(BR)CES}$	55	70	—	Volts
Breakdown Voltage E to B	I_C = 0 A, I_E = 5 mA	$V_{(BR)EBO}$	3.5	5	—	Volts
DC Current Gain	V_{CE} = 5 V, I_C = 1 A	h_{FE}	20	50	100	—

RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{CC} = 25 Vdc, P_{OUT} = 50 W, I_{CQ} = 200 mA, f = 900 MHz)	G_{pe}	8.0	9.5	—	dB
Collector Efficiency (V_{CC} = 25 Vdc, P_{OUT} = 50 W, I_{CQ} = 200 mA, f = 900 MHz)	η_C	50	—	—	%
Intermodulation Distortion (V_{CC} = 25 Vdc, P_{OUT} = 50 $W_{(PEP)}$, I_{CQ} = 200 mA, f_1 = 899 MHz, f_2 = 900 MHz)	IMD	—	-21	—	dBc
Load Mismatch Tolerance (V_{CC} = 25 Vdc, P_{OUT} = 50 W, I_{CQ} = 200 mA f = 900 MHz—all phase angles at frequency of test)	Ψ	—	—	10:1	—

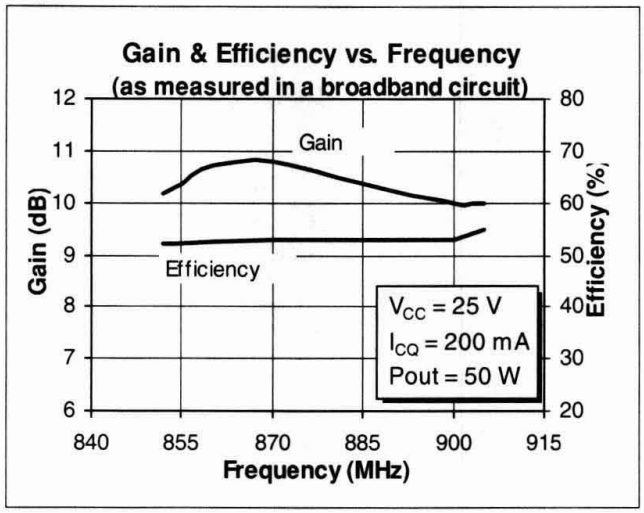
Impedance Data (data shown for fixed-tuned broadband circuit)

(V_{CC} = 25 Vdc, P_{OUT} = 50 W, I_{CQ} = 200 mA)



Frequency	Z Source Ω		Z Load Ω	
MHz	R	jX	R	jX
860	7.1	-1.7	5.0	-3.5
880	6.9	-1.2	5.1	-3.9
900	6.7	-0.6	5.2	-4.5

Typical Performance



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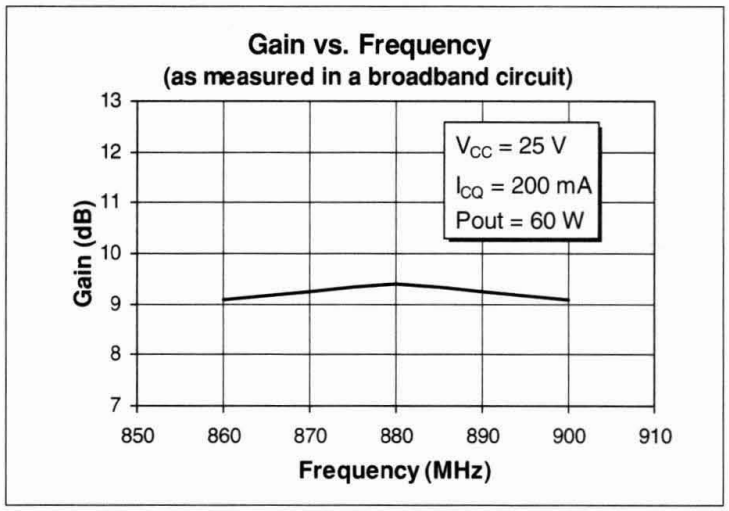
ERICSSON

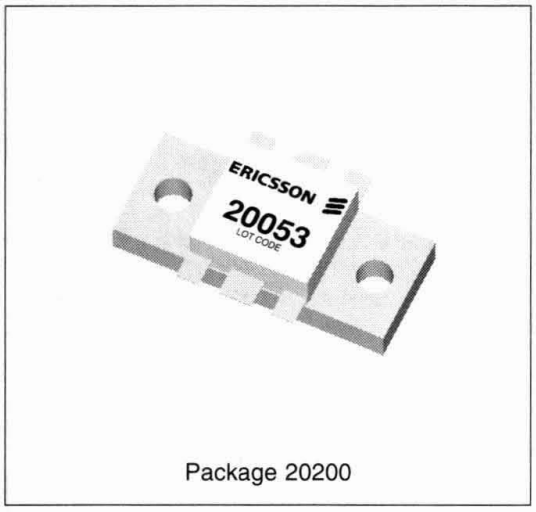
PTB 20053
60 Watts, 860–900 MHz
Cellular Radio RF Power Transistor

Description

The PTB 20053 is a class AB, NPN, common emitter RF power transistor intended for 25 Vdc operation from 860 to 900 MHz. Rated at 60 watts minimum output power, it may be used for both CW and PEP applications. Ion implantation, nitride surface passivation and gold metallization are used to ensure excellent device reliability. 100% lot traceability is standard.

- 60 Watts, 860–900 MHz
- Class AB Characteristics
- 50% Collector Efficiency at 60 Watts
- Gold Metallization
- Silicon Nitride Passivated





Package 20200

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CER}	40	Vdc
Collector-Base Voltage	V_{CBO}	65	Vdc
Emitter-Base Voltage (collector open)	V_{EBO}	4.0	Vdc
Collector Current (continuous)	I_C	8.0	Adc
Total Device Dissipation at T_{flange} = 25°C Above 25°C derate by	P_D	145 0.83	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{flange} = 70°C)	$R_{\theta JC}$	1.2	°C/W

Electrical Characteristics (100% Tested)

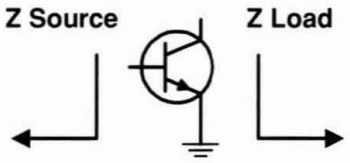
Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Breakdown Voltage C to E	I_B = 0 A, I_C = 50 mA	$V_{(BR)CEO}$	25	30	—	Volts
Breakdown Voltage C to E	V_{BE} = 0 V, I_C = 50 mA	$V_{(BR)CES}$	55	70	—	Volts
Breakdown Voltage E to B	I_C = 0 A, I_E = 5 mA	$V_{(BR)EBO}$	3.5	5.0	—	Volts
DC Current Gain	V_{CE} = 5 V, I_C = 250 mA	h_{FE}	20	50	120	—

RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{CC} = 25 Vdc, P_{OUT} = 60 W, I_{CQ} = 200 mA, f = 900 MHz)	G_{pe}	8.0	9.5	—	dB
Collector Efficiency (V_{CC} = 25 Vdc, P_{OUT} = 60 W, I_{CQ} = 200 mA, f = 900 MHz)	η_C	50	—	—	%
Load Mismatch Tolerance (V_{CC} = 25 Vdc, P_{OUT} = 60 W, I_{CQ} = 200 mA, f = 900 MHz—all phase angles at frequency of test)	Ψ	—	—	10:1	—

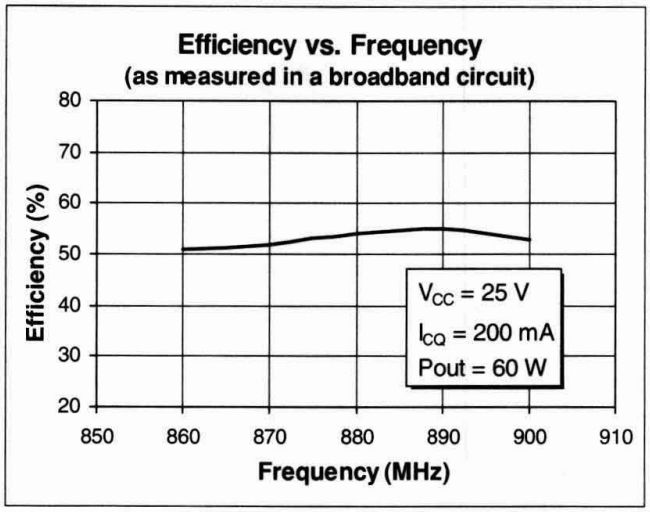
Impedance Data (data shown for fixed-tuned broadband circuit)

(V_{CC} = 25 Vdc, P_{OUT} = 60 W, I_{CQ} = 200 mA)



Frequency	Z Source Ω		Z Load Ω	
MHz	R	jX	R	jX
860	4.3	0.2	3.0	0.6
880	4.1	1.1	2.8	1.4
900	4.1	1.7	2.8	1.9

Typical Performance



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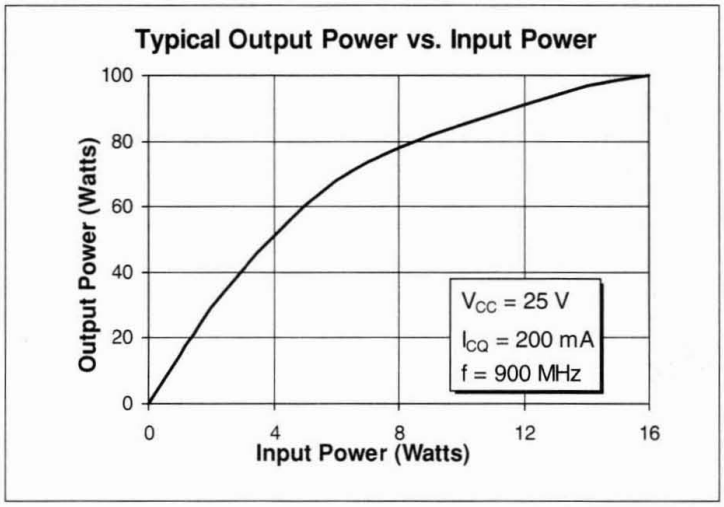
ERICSSON

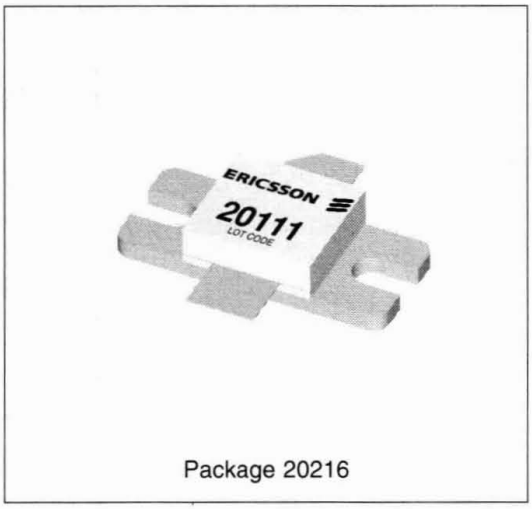
PTB 20111
85 Watts, 860–900 MHz
Cellular Radio RF Power Transistor

Description

The PTB 20111 is a class AB, NPN, common emitter RF power transistor intended for 25 Vdc operation from 860 to 900 MHz. Rated at 85 watts minimum output power, it may be used for both CW and PEP applications. Ion implantation, nitride surface passivation and gold metallization are used to ensure excellent device reliability. 100% lot traceability is standard.

- 25 Volt, 860–900 MHz Characteristics
  - Output Power = 85 Watts
  - Collector Efficiency = 50% at 85 Watts
  - IMD = -30 dBc Max at 60 W(PEP)
- Class AB Characteristics
- Gold Metallization
- Silicon Nitride Passivated





Package 20216

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CER}	40	Vdc
Collector-Base Voltage	V_{CBO}	65	Vdc
Emitter-Base Voltage (collector open)	V_{EBO}	4.0	Vdc
Collector Current (continuous)	I_C	20	Adc
Total Device Dissipation at T_{flange} = 25°C Above 25°C derate by	P_D	159 0.91	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{flange} = 70°C)	$R_{\theta JC}$	1.1	°C/W

Electrical Characteristics (100% Tested)

Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Breakdown Voltage C to E	I_B = 0 A, I_C = 100 mA	$V_{(BR)CEO}$	25	30	—	Volts
Breakdown Voltage C to E	V_{BE} = 0 V, I_C = 100 mA	$V_{(BR)CES}$	55	70	—	Volts
Breakdown Voltage E to B	I_C = 0 A, I_E = 5 mA	$V_{(BR)EBO}$	3.5	5	—	Volts
DC Current Gain	V_{CE} = 5 V, I_C = 1 A	h_{FE}	20	50	100	—

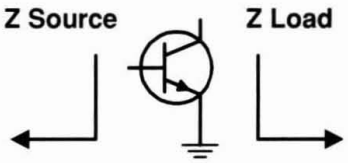
RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{CC} = 25 Vdc, P_{OUT}= 85 W, I_{CQ} = 200 mA, f = 900 MHz)	G_{pe}	8.5	9.5	—	dB
Collector Efficiency (V_{CC} = 25 Vdc, P_{OUT} = 85 W, I_{CQ} = 200 mA, f = 900 MHz)	η_C	50	—	—	%
Load Mismatch Tolerance (V_{CC} = 25 Vdc, P_{OUT} = 60 W(PEP), I_{CQ} = 200 mA, f = 900 MHz—all phase angles at frequency of test)	Ψ	—	—	10:1	—

Impedance Data (data shown for fixed-tuned broadband circuit)

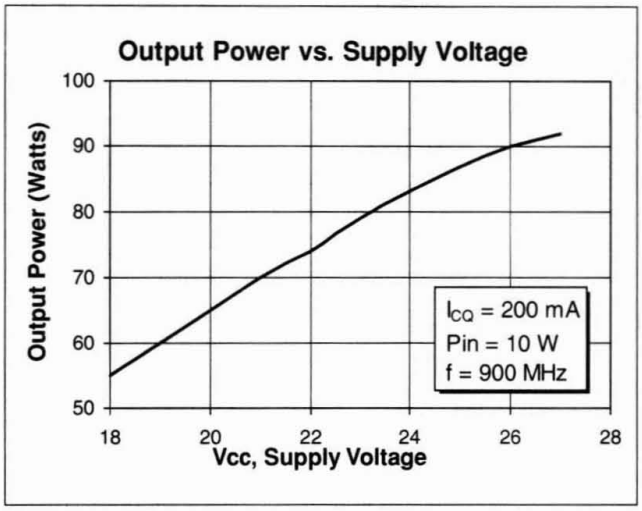
3

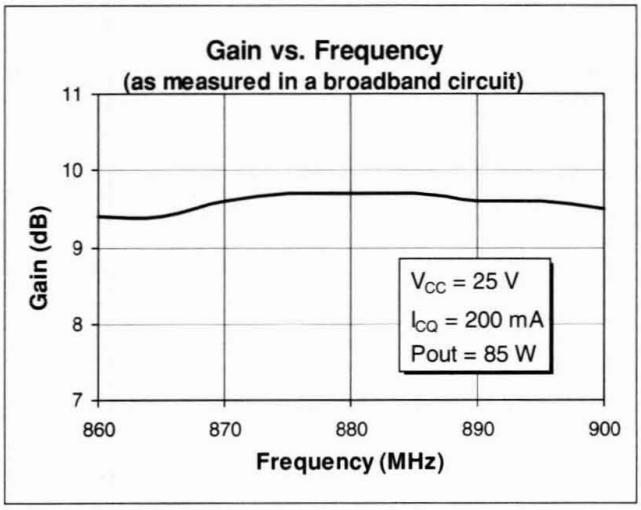
(V_{CC} = 25 Vdc, P_{OUT} = 85 W, I_{CQ} = 200 mA)

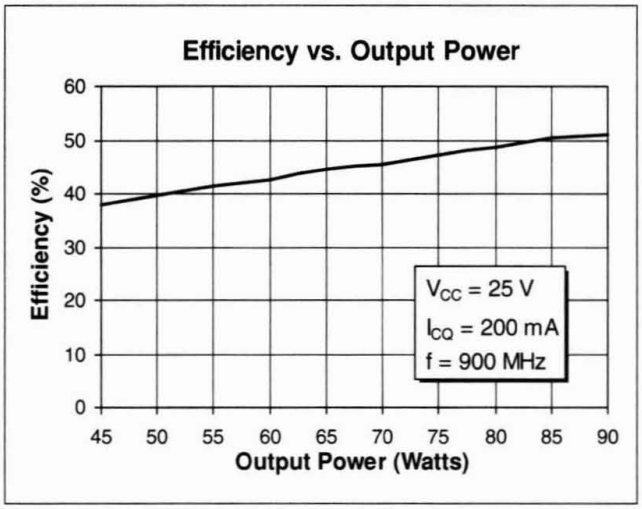


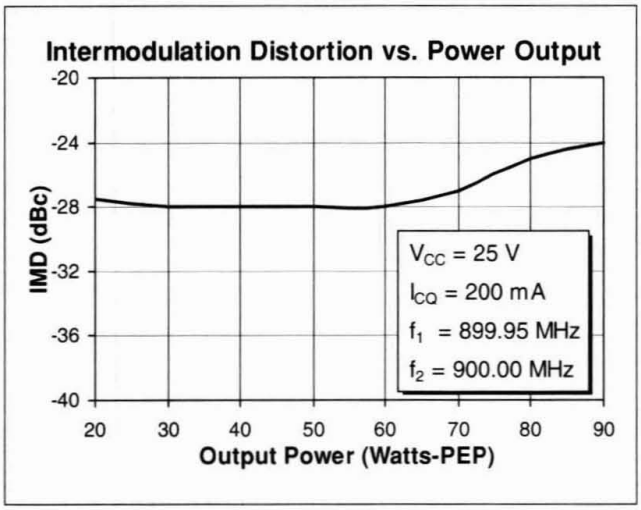
Frequency	Z Source Ω		Z Load Ω	
MHz	R	jX	R	jX
860	1.7	-0.8	1.7	-1.6
880	2.0	-1.2	1.8	-1.9
900	1.7	-0.8	1.7	-1.6

Typical Performance









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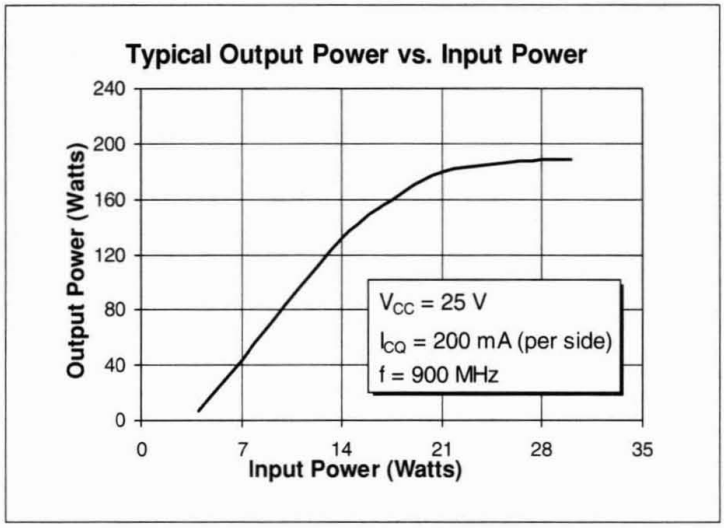
ERICSSON

PTB 20017
150 Watts, 860–900 MHz
Cellular Radio RF Power Transistor

Description

The PTB 20017 is a class AB, NPN, common emitter RF power transistor intended for 25 Vdc operation across the 860 to 900 MHz cellular radio frequency band. Rated at 150 watts minimum output power, it may be used for both CW and PEP applications. Ion implantation, nitride surface passivation and gold metallization are used to ensure excellent device reliability. 100% lot traceability is standard.

- 150 Watts, 860–900 MHz
- Class AB Characteristics
- 50% Collector Efficiency at 150 Watts
- Gold Metallization
- Silicon Nitride Passivated



Package 20224

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage (1)	V_{CER}	40	Vdc
Collector-Base Voltage (1)	V_{CBO}	60	Vdc
Emitter-Base Voltage (collector open)	V_{EBO}	4.0	Vdc
Collector Current (continuous)	I_C	25	Adc
Total Device Dissipation at T_{flange} = 25°C Above 25°C derate by	P_D	330 1.89	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{flange} = 70°C)	$R_{\theta JC}$	0.53	°C/W

(1)per side

Electrical Characteristics (100% Tested—characteristics, conditions and limits shown per side)

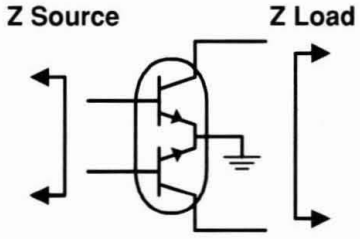
Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Breakdown Voltage C to E	I_B = 0 A, I_C = 100 mA	$V_{(BR)CEO}$	25	30	—	Volts
Breakdown Voltage C to E	V_{BE} = 0 V, I_C = 100 mA	$V_{(BR)CES}$	55	70	—	Volts
Breakdown Voltage E to B	I_C = 0 A, I_E = 5 mA	$V_{(BR)EBO}$	3.5	5	—	Volts
DC Current Gain	V_{CE} = 5 V, I_C = 1 A	h_{FE}	20	50	100	—

RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{CC} = 25 Vdc, P_{OUT} = 150 W, I_{CQ} = 200 mA per side, f = 900 MHz)	G_{pe}	8.0	9.0	—	dB
Collector Efficiency (V_{CC} = 25 Vdc, P_{OUT} = 150 W, I_{CQ} = 200 mA per side, f = 900 MHz)	η_C	50	—	—	%
Intermodulation Distortion (V_{CC} = 25 Vdc, P_{OUT} = 150 W(PEP), I_{CQ} = 200 mA per side, f_1 = 899 MHz, f_2 = 900 MHz)	IMD	—	-28	—	dBc
Load Mismatch Tolerance (V_{CC} = 25 Vdc, P_{OUT} = 150 W(PEP), I_{CQ} = 200 mA per side f = 900 MHz—all phase angles at frequency of test)	Ψ	—	—	5:1	—

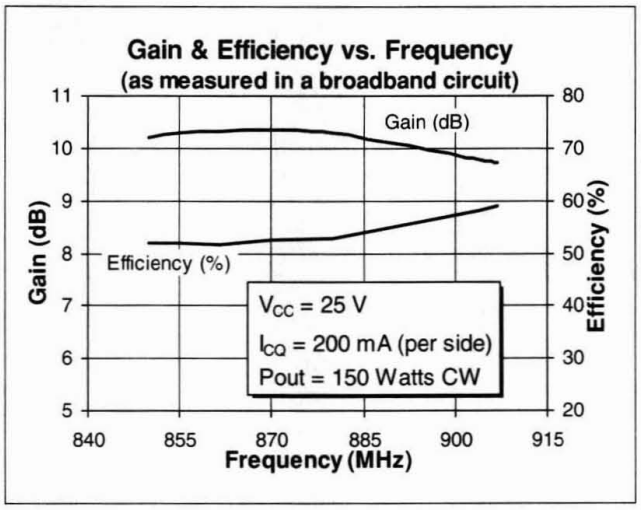
Impedance Data (data shown for fixed-tuned broadband circuit)

(V_{CC} = 25 Vdc, P_{OUT} = 150 W, I_{CQ} = 200 mA per side)



Frequency	Z Source Ω		Z Load Ω	
MHz	R	jX	R	jX
860	3.4	-6.7	3.5	-3.1
880	3.1	-6.1	3.4	-2.6
900	2.9	-5.6	3.2	-2.1

Typical Performance



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ERICSSON

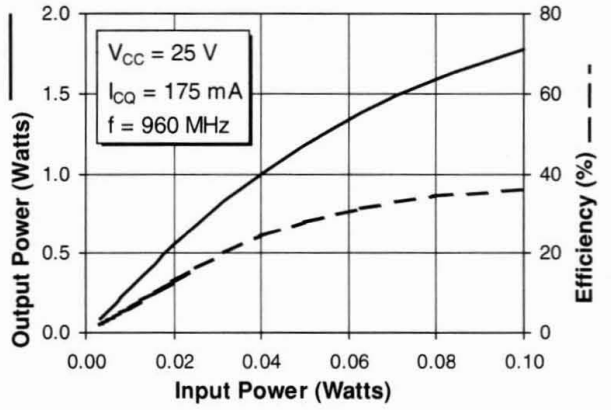
PTB 20189
1 Watt, 900–960 MHz
Cellular Radio RF Power Transistor

Description

The PTB 20189 is an NPN, common emitter RF power transistor intended for 25 Vdc class A or AB operation from 900 to 960 MHz. Rated at 1 watt minimum output power, it may be used for both CW and PEP applications. Ion implantation, nitride surface passivation and gold metallization are used to ensure excellent device reliability. 100% lot traceability is standard.

- 25 Volt, 900–960 MHz Characteristics
  - Output Power = 1 Watt
  - Gain = 12 dB Min at 1 Watt
- Class A/AB Characteristics
- Gold Metallization
- Silicon Nitride Passivated
- Surface Mountable
- Available in Tape and Reel

Typical Output Power and Efficiency vs. Input Power



Package 20227

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CER}	40	Vdc
Collector-Base Voltage	V_{CBO}	50	Vdc
Emitter-Base Voltage (collector open)	V_{EBO}	4.0	Vdc
Collector Current (continuous)	I_C	0.5	Adc
Total Device Dissipation at T_{flange} = 25°C Above 25°C derate by	P_D	11 0.063	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{flange} = 70°C)	$R_{\theta JC}$	16.0	°C/W

PTB 20189

ERICSSON

Electrical Characteristics (100% Tested)

Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Breakdown Voltage C to E	I_B = 0 A, I_C = 5 mA	$V_{(BR)CEO}$	28	32	—	Volts
Breakdown Voltage C to E	V_{BE} = 0 V, I_C = 5 mA	$V_{(BR)CES}$	55	70	—	Volts
Breakdown Voltage E to B	I_C = 0 A, I_E = 5 mA	$V_{(BR)EBO}$	3.5	5	—	Volts
DC Current Gain	V_{CE} = 5 V, I_C = 1.5 A	h_{FE}	20	50	120	—

RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{CC} = 25 Vdc, P_{OUT} = 1 W, I_{CQ} = 175 mA, f = 960 MHz)	G_{pe}	12	14	—	dB
Collector Efficiency (V_{CC} = 25 Vdc, P_{OUT} = 1 W, I_{CQ} = 175 mA, f = 960 MHz)	η_C	—	25	—	%
Load Mismatch Tolerance (V_{CC} = 25 Vdc, P_{OUT} = 1 W, I_{CQ} = 175 mA, f = 960 MHz—all phase angles at frequency of test)	Ψ	—	—	10:1	—

Impedance Data (data shown for fixed-tuned broadband circuit)

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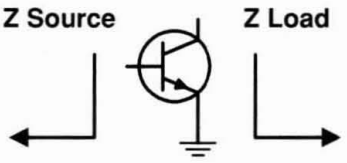
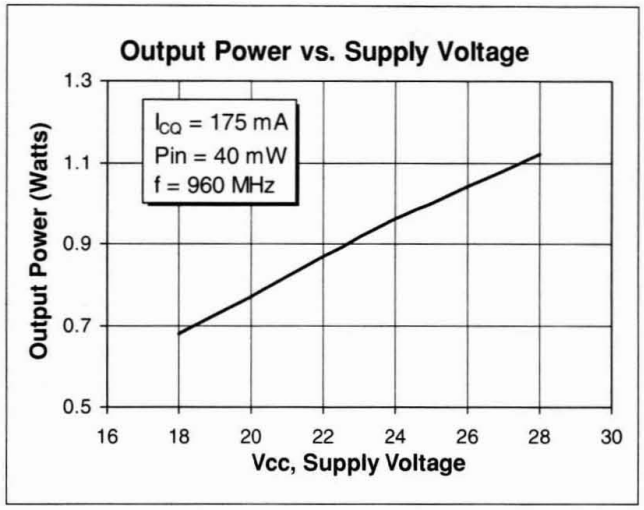
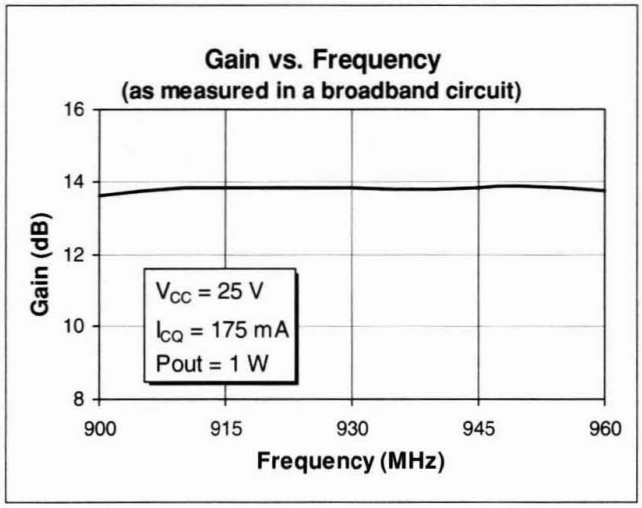
(V_{CC} = 25 Vdc, P_{OUT} = 1 W, I_{CQ} = 175 mA)



Frequency	Z Source Ω		Z Load Ω	
MHz	R	jX	R	jX
900	3.0	-0.4	9.0	6.0
930	3.0	0.0	9.0	7.5
960	2.9	0.5	9.2	8.9

Typical Performance





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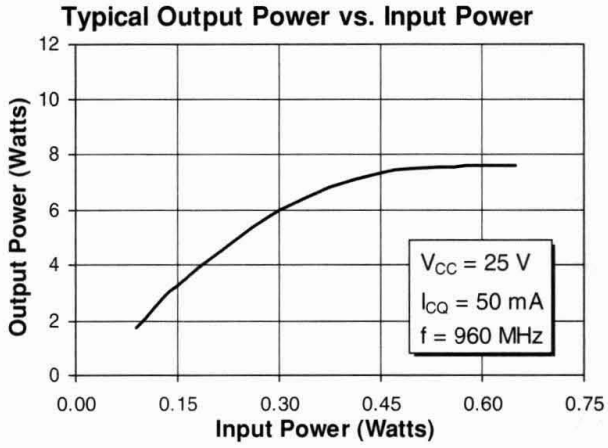
ERICSSON

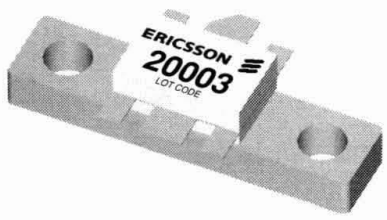
PTB 20003
4 Watts, 915–960 MHz
Cellular Radio RF Power Transistor

Description

The PTB 20003 is a class AB, NPN, common emitter RF power transistor intended for 25 Vdc operation across the 915 to 960 MHz frequency band. Rated at 4 Watts minimum output power, it may be used for both CW and PEP applications. Ion implantation, nitride surface passivation and gold metallization are used to ensure excellent device reliability. 100% lot traceability is standard.

- Specified 25 Volts
- 4 Watts, 915–960 MHz
- Class AB Characteristics
- 50% Collector Efficiency at 4 Watts
- Gold Metallization
- Silicon Nitride Passivated





Package 20201

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CER}	40	Vdc
Collector-Base Voltage	V_{CBO}	50	Vdc
Emitter-Base Voltage (collector open)	V_{EBO}	4.0	Vdc
Collector Current (continuous)	I_C	1.7	Adc
Total Device Dissipation at T_{flange} = 25°C Above 25°C derate by	P_D	35 0.2	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{flange} = 70°C)	$R_{\theta JC}$	5.0	°C/W

Electrical Characteristics (100% Tested)

Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Breakdown Voltage C to E	I_B = 0 A, I_C = 50 mA	$V_{(BR)CEO}$	25	30	—	Volts
Breakdown Voltage C to E	V_{BE} = 0 V, I_C = 50 mA	$V_{(BR)CES}$	55	70	—	Volts
Breakdown Voltage E to B	I_C = 0 A, I_E = 5 mA	$V_{(BR)EBO}$	4	5	—	Volts
DC Current Gain	V_{CE} = 5 V, I_C = 250 mA	h_{FE}	20	50	120	—

RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{CC} = 25 Vdc, P_{OUT} = 4 W, I_{CQ} = 50 mA, f = 960 MHz)	G_{pe}	11	13	—	dB
Collector Efficiency (V_{CC} = 25 Vdc, P_{out} = 4 W, I_{CQ} = 50 mA, f = 960 MHz)	η_C	50	—	—	%
Intermodulation Distortion (V_{CC} = 25 Vdc, P_{OUT} = 4 W(PEP), I_{CQ} = 50 mA, f_1 = 959.999 MHz, f_2 = 960.000 MHz)	IMD	—	-28	—	dBc
Load Mismatch Tolerance (V_{CC} = 25 Vdc, P_{OUT} = 4 W, I_{CQ} = 50 mA, f = 960 MHz—all phase angles at frequency of test)	Ψ	—	—	30:1	—

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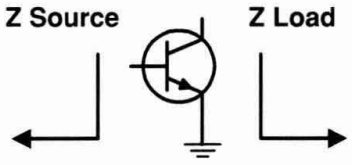
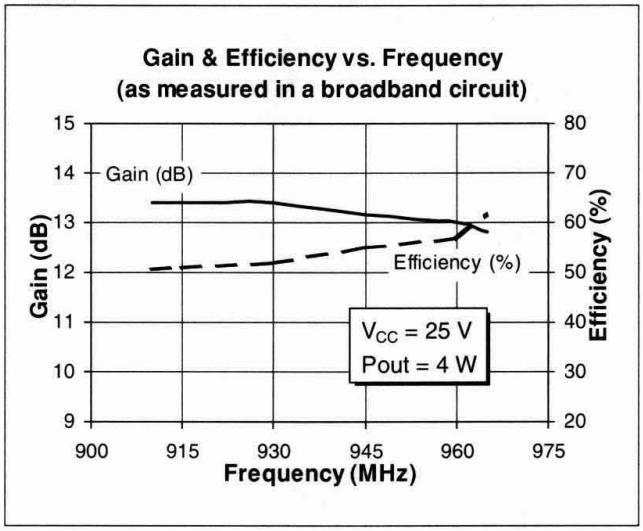
Impedance Data (data shown for fixed-tuned broadband circuit)

(V_{CC} = 25 Vdc, P_{OUT} = 4 W, I_{CQ} = 50 mA)



Frequency	Z Source Ω		Z Load Ω	
MHz	R	jX	R	jX
915	6.7	-1.8	6.8	15.5
935	6.8	-1.3	6.9	16.0
960	6.8	-0.7	7.0	17.0

Typical Performance



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ERICSSON

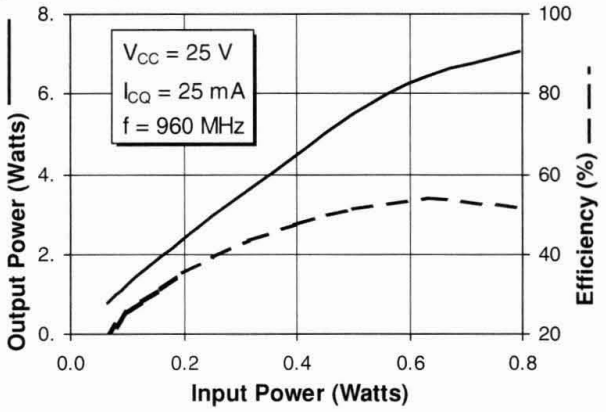
PTB 20181
6 Watts, 915–960 MHz
Cellular Radio RF Power Transistor

Description

The PTB 20181 is an NPN, common emitter RF power transistor intended for 25 Vdc class AB operation from 915 to 960 MHz. Rated at 6 watts minimum output power, it may be used for both CW and PEP applications. Ion implantation, nitride surface passivation and gold metallization are used to ensure excellent device reliability. 100% lot traceability is standard.

- 25 Volt, 915–960 MHz Characteristics
  - Output Power = 6 Watts
  - Gain = 9.0 dB Min at 6 Watts
- Class AB Characteristics
- Gold Metallization
- Silicon Nitride Passivated
- Surface Mountable
- Available in Tape and Reel

Typical Output Power and Efficiency vs. Input Power



Package 20227

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CER}	55	Vdc
Collector-Base Voltage	V_{CBO}	60	Vdc
Emitter-Base Voltage (collector open)	V_{EBO}	4.0	Vdc
Collector Current (continuous)	I_C	1.1	Adc
Total Device Dissipation at T_{flange} = 25°C Above 25°C derate by	P_D	22 0.125	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{flange} = 70°C)	$R_{\theta JC}$	8.0	°C/W

Electrical Characteristics (100% Tested)

Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Breakdown Voltage C to E	I_B = 0 A, I_C = 5 mA	$V_{(BR)CEO}$	28	32	—	Volts
Breakdown Voltage C to E	V_{BE} = 0 V, I_C = 5 mA	$V_{(BR)CES}$	60	70	—	Volts
Breakdown Voltage E to B	I_C = 0 A, I_E = 5 mA	$V_{(BR)EBO}$	3.5	5	—	Volts
DC Current Gain	V_{CE} = 5 V, I_C = 250 mA	h_{FE}	20	50	120	—

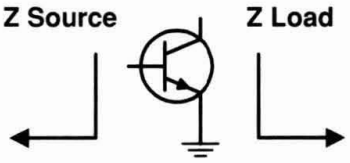
RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{CC} = 25 Vdc, P_{OUT} = 6 W, I_{CQ} = 25 mA, f = 960 MHz)	G_{pe}	9	10	—	dB
Collector Efficiency (V_{CC} = 25 Vdc, P_{OUT} = 6 W, I_{CQ} = 25 mA, f = 960 MHz)	η_C	50	—	—	%
Load Mismatch Tolerance (V_{CC} = 25 Vdc, P_{OUT} = 6 W, I_{CQ} = 25 mA, f = 960 MHz—all phase angles at frequency of test)	Ψ	—	—	30:1	—

Impedance Data (data shown for fixed-tuned broadband circuit)

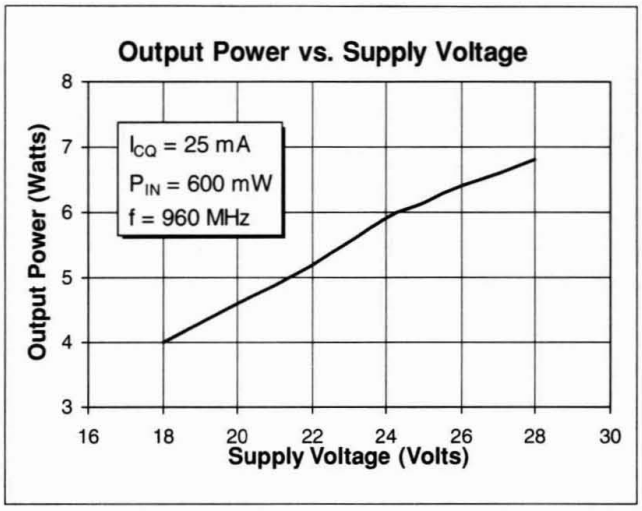
3

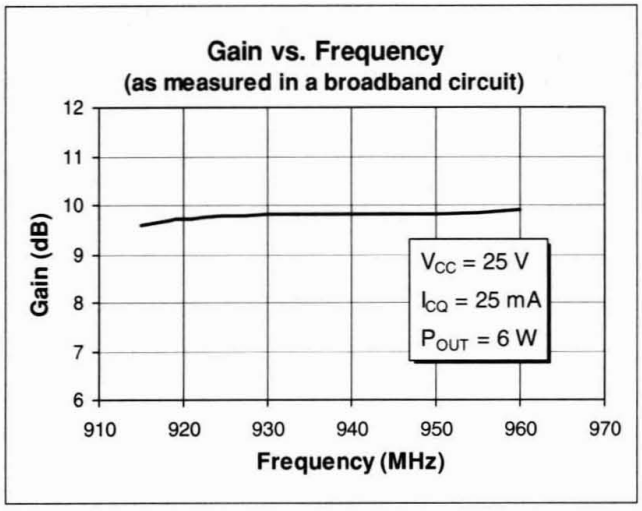
(V_{CC} = 25 Vdc, P_{OUT} = 6 W, I_{CQ} = 25 mA)



Frequency	Z Source Ω		Z Load Ω	
MHz	R	jX	R	jX
915	2.5	-1.4	6.3	9.8
960	2.6	-0.8	7.0	12.4

Typical Performance





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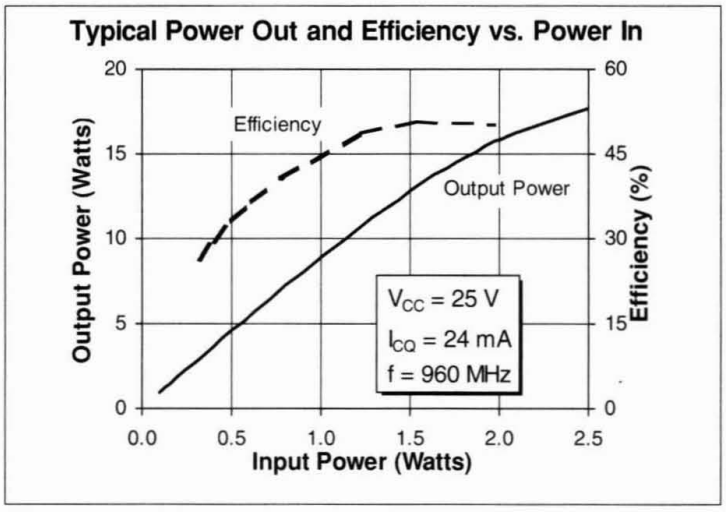
ERICSSON

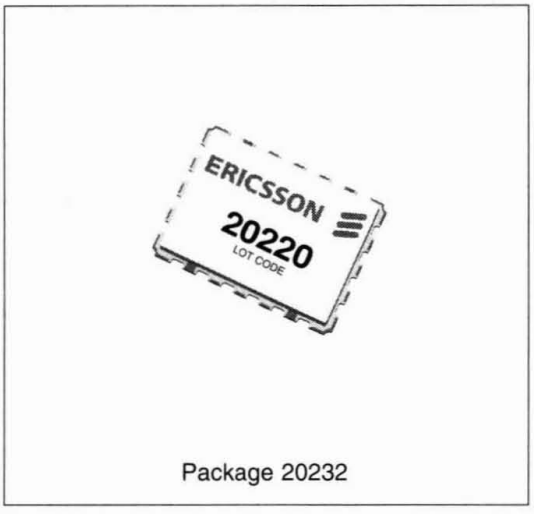
PTB 20220
15 Watts, 915–960 MHz
Cellular Radio RF Power Transistor

Description

The PTB 20220 is a class AB, NPN, common emitter RF power transistor intended for 25 Vdc operation across the 915 to 960 MHz frequency band. Rated at 15 watts minimum output power for PEP applications, it may be used for both CW and PEP applications. Ion implantation, nitride surface passivation and gold metallization ensure excellent device reliability. 100% lot traceability is standard.

- 15 Watts, 915–960 MHz
- Class AB Characteristics
- 50% Collector Efficiency at 15 Watts
- Surface Mountable
- Gold Metallization
- Silicon Nitride Passivated





Package 20232

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CER}	65	Vdc
Collector-Base Voltage	V_{CBO}	65	Vdc
Emitter-Base Voltage (collector open)	V_{EBO}	4.0	Vdc
Collector Current (continuous)	I_C	4.0	Adc
Total Device Dissipation at T_{flange} = 25°C Above 25°C derate by	P_D	37 0.21	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance	$R_{\theta JC}$	4.7	°C/W

PTB 20220

ERICSSON

Electrical Characteristics (100% Tested)

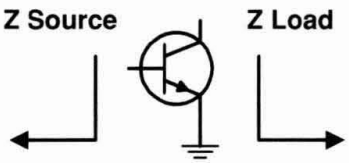
Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Breakdown Voltage C to E	I_B = 0 A, I_C = 5 mA	$V_{(BR)CEO}$	25	—	—	Volts
Breakdown Voltage C to E	V_{BE} = 0 V, I_C = 5 mA	$V_{(BR)CES}$	65	—	—	Volts
Breakdown Voltage E to B	I_C = 0 A, I_E = 5 mA	$V_{(BR)EBO}$	4	5	—	Volts
DC Current Gain	V_{CE} = 5 V, I_C = 250 mA	h_{FE}	35	—	—	—
Output Capacitance	V_{CC} = 25 V, I_E = 0 A, f = 1 MHz	Cob	—	14.1	—	pF

RF Specifications (100% Tested)

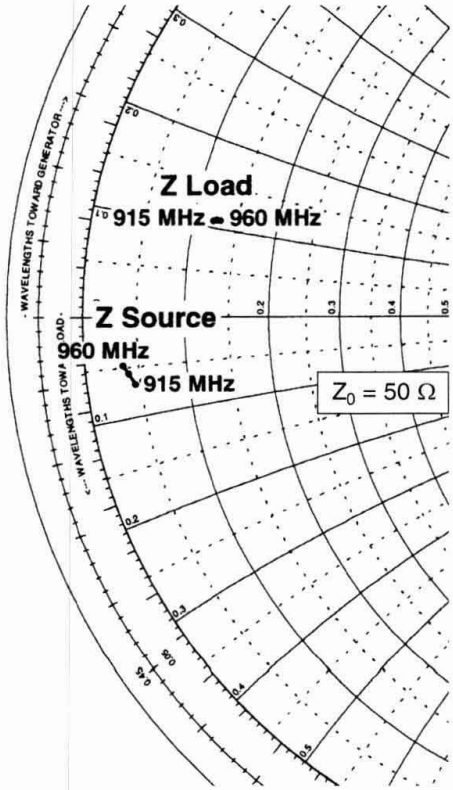
Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{CC} = 25 Vdc, P_{OUT} = 5 W, I_{CQ} = 24 mA, f = 960 MHz)	G_{pe}	8.75	—	—	dB
Gain Compression (V_{CC} = 25 Vdc, P_{OUT} = 15 W, I_{CQ} = 24 mA, f = 960 MHz)	P-1dB	15	—	—	Watts
Collector Efficiency (V_{CC} = 25 Vdc, P_{OUT} = 15 W, I_{CQ} = 24 mA, f = 960 MHz)	η_C	50	—	—	%
Load Mismatch Tolerance (V_{CC} = 25 Vdc, P_{OUT} = 15 W, I_{CQ} = 24 mA, f = 960 MHz —all phase angles at frequency of test)	Ψ	—	—	30:1	—

Impedance Data (data shown for fixed-tuned broadband circuit)

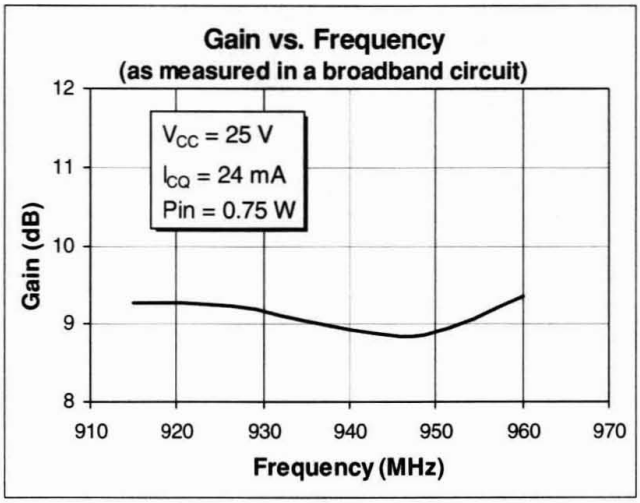
(V_{CC} = 25 Vdc, P_{OUT} = 15 W, I_{CQ} = 24 mA)



Frequency	Z Source Ω		Z Load Ω	
MHz	R	jX	R	jX
915	2.26	-3.40	6.12	5.42
935	1.99	-2.84	6.30	5.51
960	1.75	-2.41	6.50	5.52



Typical Performance



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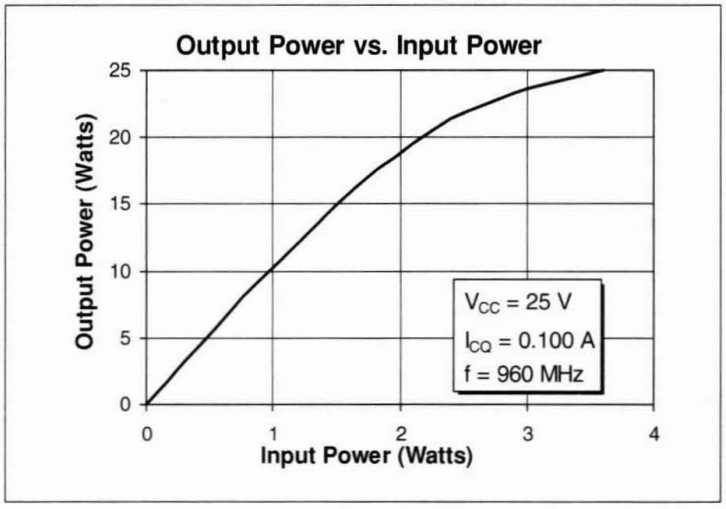
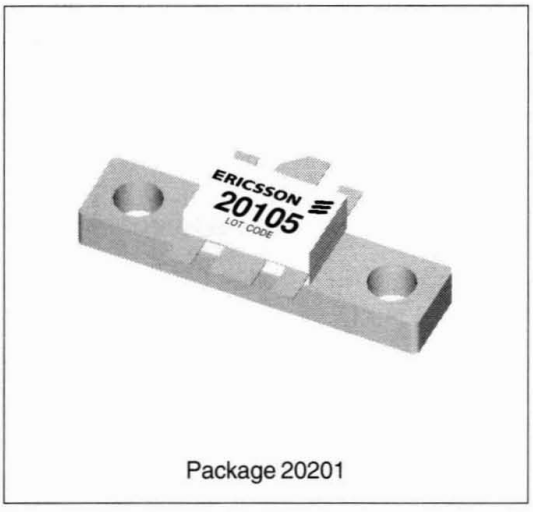
PTB 20105
20 Watts, 925–960 MHz
Cellular Radio RF Power Transistor

Description

The PTB 20105 is a class AB, NPN, common emitter RF power transistor intended for 25 Vdc operation from 925 to 960 MHz. Rated at 20 watts minimum output power, it may be used for both CW and PEP applications. Ion implantation, nitride surface passivation and gold metallization are used to ensure excellent device reliability. 100% lot traceability is standard.

- Class AB Characteristics
- Performance at 960 MHz, 25 V_{CC}
  - Output Power = 20 W
  - Efficiency = 50% Min
- Gold Metallization
- Silicon Nitride Passivated





Package 20201

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CER}	40	Vdc
Collector-Base Voltage	V_{CBO}	50	Vdc
Emitter-Base Voltage (collector open)	V_{EBO}	4.0	Vdc
Collector Current (continuous)	I_C	5.0	Adc
Total Device Dissipation at T_{flange} = 25°C Above 25°C derate by	P_D	70 0.4	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{flange} = 70°C)	$R_{\theta JC}$	2.5	°C/W

Electrical Characteristics (100% Tested)

Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Breakdown Voltage C to E	I_B = 0 A, I_C = 100 mA	$V_{(BR)CEO}$	25	30	—	Volts
Breakdown Voltage C to E	V_{BE} = 0 V, I_C = 100 mA	$V_{(BR)CES}$	55	70	—	Volts
Breakdown Voltage E to B	I_C = 0 A, I_E = 5 mA	$V_{(BR)EBO}$	3.5	5.0	—	Volts
DC Current Gain	V_{CE} = 5 V, I_C = 1 A	h_{FE}	20	50	120	—

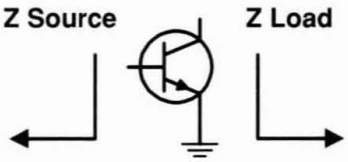
RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{CC} = 25 Vdc, P_{OUT} = 20 W, I_{CQ} = 100 mA, f = 960 MHz)	G_{pe}	9	10	—	dB
Collector Efficiency (V_{CC} = 25 Vdc, P_{OUT} = 20 W, I_{CQ} = 100 mA, f = 960 MHz)	η_C	50	—	—	%
Load Mismatch Tolerance (V_{CC} = 25 Vdc, P_{OUT} = 20 W, I_{CQ} = 100 mA, f = 960 MHz—all phase angles at frequency of test)	Ψ	—	—	30:1	—

Impedance Data (data shown for fixed-tuned broadband circuit)

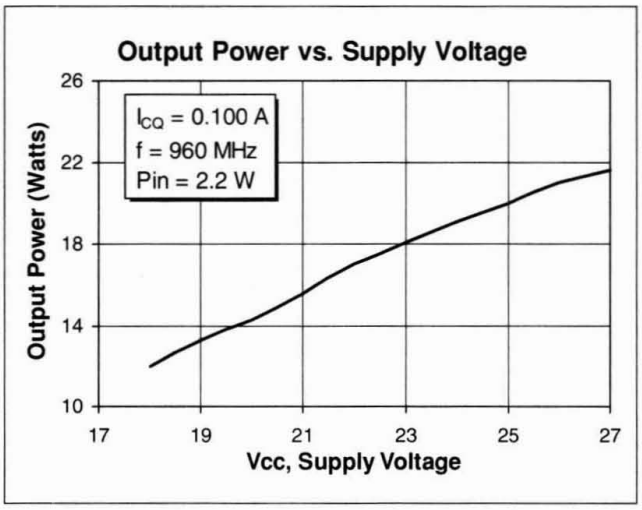
3

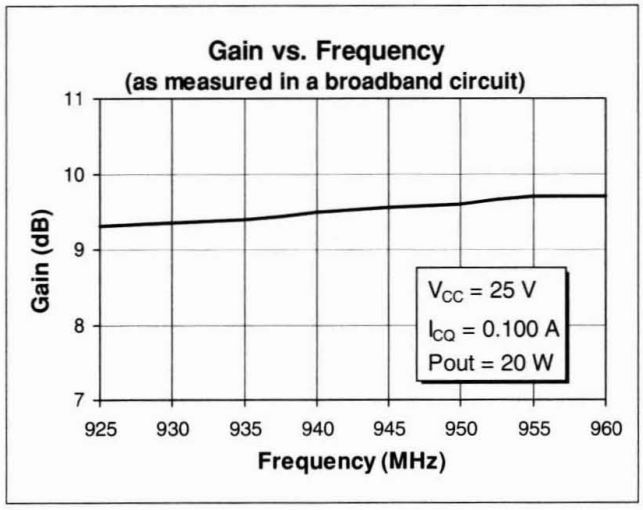
(V_{CC} = 25 Vdc, P_{OUT} = 20 W, I_{CQ} = 100 mA)

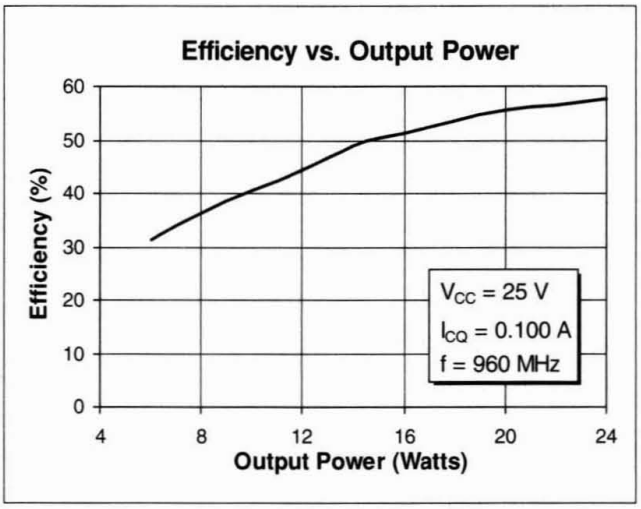


Frequency	Z Source Ω		Z Load Ω	
MHz	R	jX	R	jX
925	3.1	-1.8	3.1	1.4
942	3.0	-1.5	2.9	1.4
960	2.9	-1.2	2.7	1.4

Typical Performance







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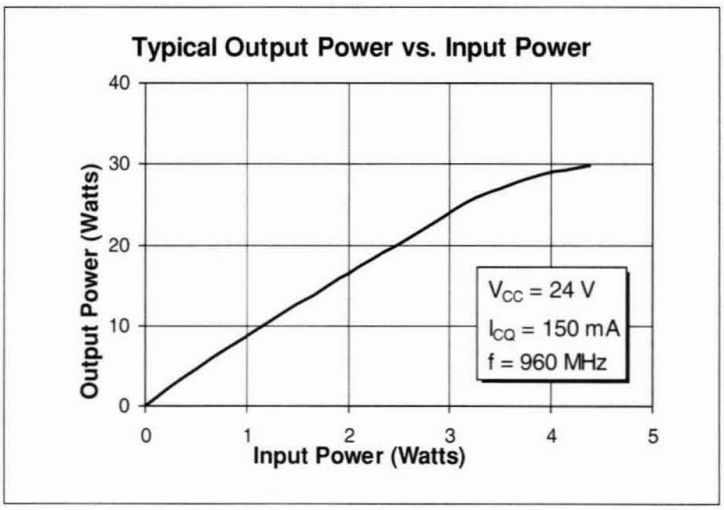
ERICSSON

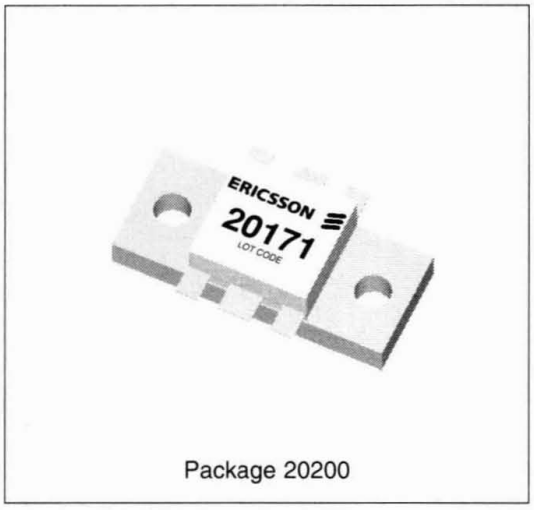
PTB 20171
25 Watts, 935–960 MHz
Cellular Radio RF Power Transistor

Description

The PTB 20171 is a class AB, NPN, common emitter RF power transistor intended for 24 Vdc operation from 935 to 960 MHz. Rated at 25 watts minimum output power, it may be used for both CW and PEP applications. Ion implantation, nitride surface passivation and gold metallization are used to ensure excellent device reliability. 100% lot traceability is standard.

- 25 Watts, 935–960 MHz
- Class AB Characteristics
- Gold Metallization
- Silicon Nitride Passivated





Package 20200

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CER}	50	Vdc
Collector-Base Voltage	V_{CBO}	50	Vdc
Emitter-Base Voltage (collector open)	V_{EBO}	4.0	Vdc
Collector Current (continuous)	I_C	5.0	Adc
Total Device Dissipation at T_{flange} = 25°C Above 25°C derate by	P_D	145 0.833	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{flange} = 70°C)	$R_{\theta JC}$	1.2	°C/W

Electrical Characteristics (100% Tested)

Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Breakdown Voltage C to E	I_B = 0 A, I_C = 10 mA, R_{BE} = 22 Ω	$V_{(BR)CER}$	50	50	—	Volts
Breakdown Voltage C to E	V_{BE} = 0 V, I_C = 10 mA	$V_{(BR)CES}$	55	60	—	Volts
Breakdown Voltage E to B	I_C = 0 A, I_E = 5 mA	$V_{(BR)EBO}$	4	5	—	Volts
DC Current Gain	V_{CE} = 5 V, I_C = 1 A	h_{FE}	20	40	—	—

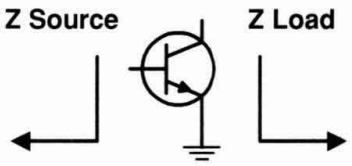
RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{CC} = 24 Vdc, P_{OUT} = 25 W, I_{CQ} = 150 mA, f = 960 MHz)	G_{pe}	—	10.0	—	dB
Collector Efficiency (V_{CC} = 24 Vdc, P_{OUT} = 25 W, I_{CQ} = 150 mA, f = 960 MHz)	η_C	—	55	—	%
Load Mismatch Tolerance (V_{CC} = 24 Vdc, P_{OUT} = 25 W, I_{CQ} = 150 mA, f = 960 MHz—all phase angles at frequency of test)	Ψ	—	—	10:1	—

Impedance Data (data shown for fixed-tuned broadband circuit)

3

(V_{CC} = 24 Vdc, P_{OUT} = 25 W, I_{CQ} = 150 mA)



Frequency	Z Source Ω		Z Load Ω	
MHz	R	jX	R	jX
935	4.25	-10.09	11.92	-8.34
947	4.11	-9.81	11.66	-8.47
960	3.97	-9.66	11.34	-8.83

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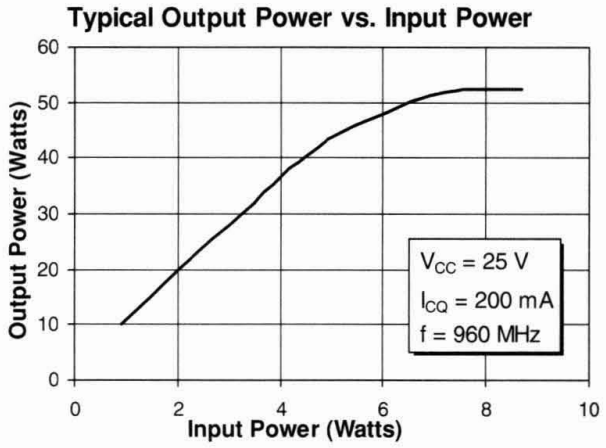
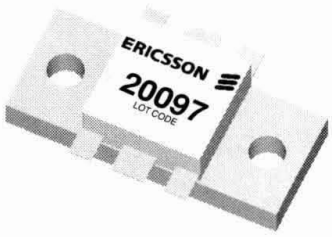
PTB 20097
40 Watts, 915–960 MHz
Cellular Radio RF Power Transistor

Description

The 20097 is a class AB, NPN, common emitter RF power transistor intended for 25 Vdc operation across the 915 to 960 MHz frequency band. Rated at 40 watts minimum output power, it may be used for both CW and PEP applications. Ion implantation, nitride surface passivation and gold metallization are used to ensure excellent device reliability. 100% lot traceability is standard.

- 40 Watts, 915–960 MHz
- Class AB Characteristics
- 50% Collector Efficiency at 40 Watts
- Gold Metallization
- Silicon Nitride Passivated





Package 20200

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CER}	40	Vdc
Collector-Base Voltage	V_{CBO}	50	Vdc
Emitter-Base Voltage (collector open)	V_{EBO}	4.0	Vdc
Collector Current (continuous)	I_C	10	Adc
Total Device Dissipation at T_{flange} = 25°C Above 25°C derate by	P_D	175 1.0	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{flange} = 70°C)	$R_{\theta JC}$	1.0	°C/W

PTB 20097

ERICSSON

Electrical Characteristics (100% Tested)

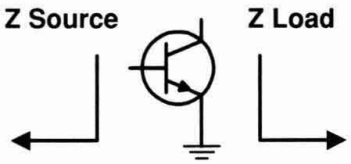
Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Breakdown Voltage C to E	I_B = 0 A, I_C = 100 mA	$V_{(BR)CEO}$	25	30	—	Volts
Breakdown Voltage C to E	V_{BE} = 0 V, I_C = 100 mA	$V_{(BR)CES}$	55	70	—	Volts
Breakdown Voltage E to B	I_C = 0 A, I_E = 5 mA	$V_{(BR)EBO}$	3.5	5	—	Volts
DC Current Gain	V_{CE} = 5 V, I_C = 1 A	h_{FE}	20	50	100	—

RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{CC} = 25 Vdc, P_{OUT} = 40 W, I_{CQ} = 200 mA, f = 960 MHz)	G_{pe}	8.5	9.5	—	dB
Collector Efficiency (V_{CC} = 25 Vdc, P_{OUT} = 40 W, I_{CQ} = 200 mA, f = 960 MHz)	η_C	50	—	—	%
Load Mismatch Tolerance (V_{CC} = 25 Vdc, P_{OUT}= 40 W, I_{CQ} = 200 mA, f = 960 MHz —all phase angles at frequency of test)	Ψ	—	—	10:1	—

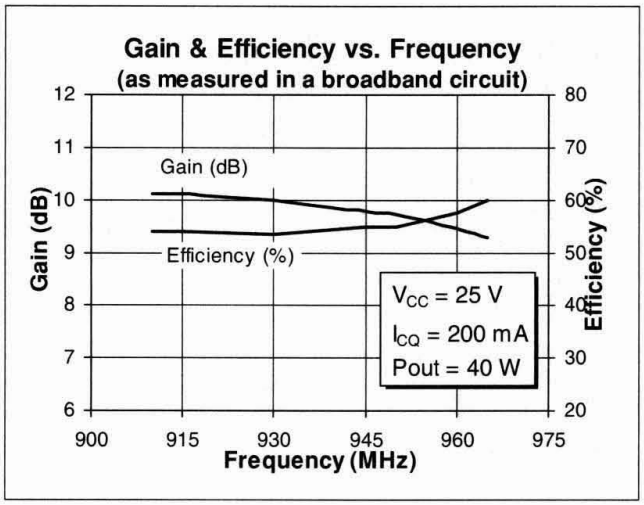
Impedance Data (data shown for fixed-tuned broadband circuit)

(V_{CC} = 25 Vdc, P_{OUT}= 40 W, I_{CQ} = 200 mA)



Frequency	Z Source Ω		Z Load Ω	
GHz	R	jX	R	jX
915	5.2	-2.8	4.9	-4.3
935	5.1	-2.6	4.7	-3.7
960	4.7	-2.1	4.6	-2.9

Typical Performance



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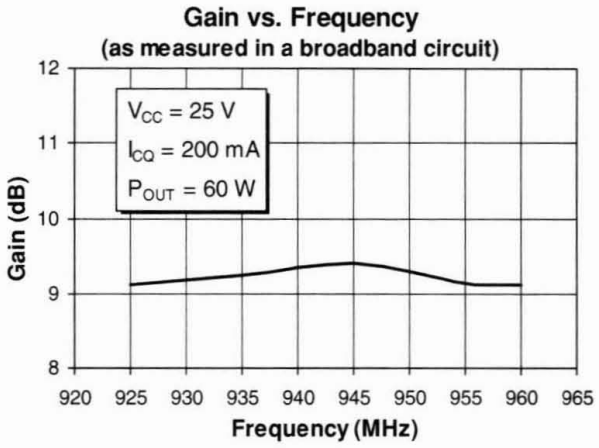
ERICSSON

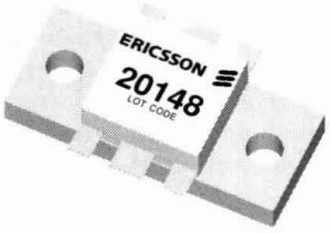
PTB 20148
60 Watts, 925–960 MHz
Cellular Radio RF Power Transistor

Description

The PTB 20148 is a class AB, NPN, common emitter RF power transistor intended for 25 Vdc operation from 925 to 960 MHz. Rated at 60 watts minimum output power, it may be used for both CW and PEP applications. Ion implantation, nitride surface passivation and gold metallization are used to ensure excellent device reliability. 100% lot traceability is standard.

- 60 Watts, 925–960 MHz
- Class AB Characteristics
- 50% Min Collector Efficiency at 60 Watts
- Gold Metallization
- Silicon Nitride Passivated





Package 20200

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CER}	40	Vdc
Collector-Base Voltage	V_{CBO}	65	Vdc
Emitter-Base Voltage (collector open)	V_{EBO}	4.0	Vdc
Collector Current (continuous)	I_C	8.0	Adc
Total Device Dissipation at T_{flange} = 25°C Above 25°C derate by	P_D	145 0.83	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{flange} = 70°C)	$R_{\theta JC}$	1.2	°C/W

Electrical Characteristics (100% Tested)

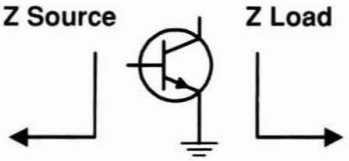
Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Breakdown Voltage C to E	I_B = 0 A, I_C = 50 mA	$V_{(BR)CEO}$	25	30	—	Volts
Breakdown Voltage C to E	V_{BE} = 0 V, I_C = 50 mA	$V_{(BR)CES}$	55	70	—	Volts
Breakdown Voltage E to B	I_C = 0 A, I_E = 5 mA	$V_{(BR)EBO}$	3.5	5.0	—	Volts
DC Current Gain	V_{CE} = 5 V, I_C = 250 mA	h_{FE}	20	50	120	—

RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{CC} = 25 Vdc, P_{OUT} = 60 W, I_{CQ} = 200 mA, f = 960 MHz)	G_{pe}	8.0	9.5	—	dB
Collector Efficiency (V_{CC} = 25 Vdc, P_{OUT} = 60 W, I_{CQ} = 200 mA, f = 960 MHz)	η_C	50	—	—	%
Load Mismatch Tolerance (V_{CC} = 25 Vdc, P_{OUT} = 60 W, I_{CQ} = 200 mA, f = 960 MHz—all phase angles at frequency of test)	Ψ	—	—	10:1	—

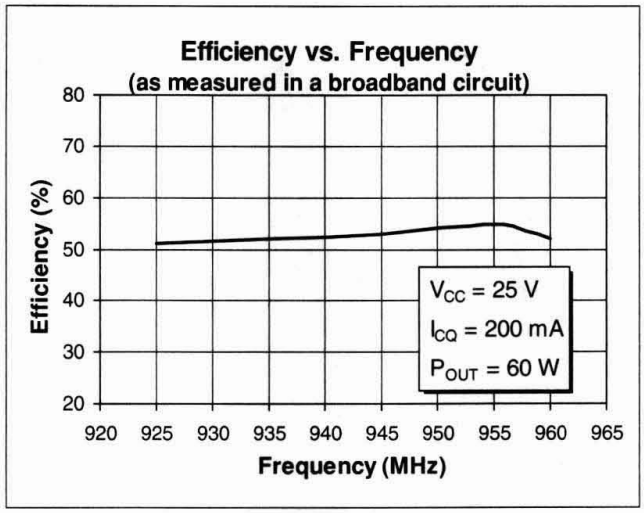
Impedance Data (data shown for fixed-tuned broadband circuit)

(V_{CC} = 25 Vdc, P_{OUT} = 60 W, I_{CQ} = 200 mA)



Frequency	Z Source Ω		Z Load Ω	
MHz	R	jX	R	jX
925	3.4	-4.2	3.8	0.6
940	3.2	-4.7	3.5	1.2
960	3.0	-5.5	3.3	2.0

Typical Performance



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ERICSSON

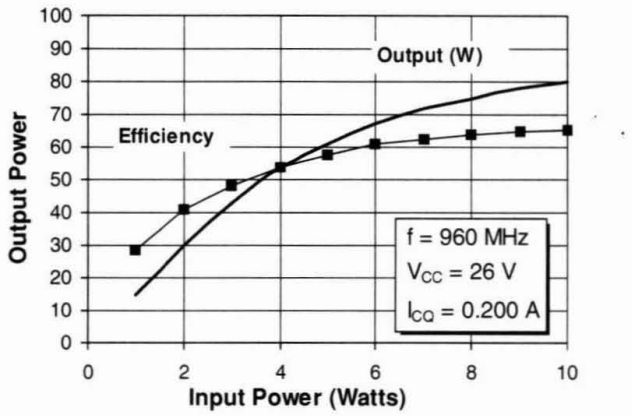
PTB 20219
70 Watts, 925–960 MHz
Cellular Radio RF Power Transistor

Description

The PTB 20219 is a class AB, NPN common emitter RF power transistor intended for 26 Vdc operation across the 925 to 960 MHz frequency band. It is rated at 70 watts minimum output power for both CW and PEP applications. Ion implantation, nitride surface passivation and gold metallization are used to ensure excellent device reliability. 100% lot traceability is standard.

- 70 Watts, 925–960 MHz
- Class AB Characteristics
- Guaranteed Performance at 26 Volts, 960 MHz
  - Output Power = 70 Watts
  - Collector Efficiency = 50% min. at 70 Watts
  - IMD = -30 max. at 50 W(PEP)
- Gold Metallization
- Silicon Nitride Passivated

Typical Output Power vs. Input Power



Package 20216

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CER}	40	Vdc
Collector-Base Voltage	V_{CBO}	65	Vdc
Emitter-Base Voltage (collector open)	V_{EBO}	4.0	Vdc
Collector Current (continuous)	I_C	20	Adc
Total Device Dissipation at T_{flange} = 25° C Above 25° C derate by	P_D	159 0.95	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{flange} = 70° C)	$R_{\theta JC}$	1.1	°C/W

PTB 20219

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Electrical Characteristics (100% Tested)

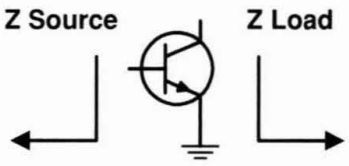
Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Breakdown Voltage C to E	I_B = 0 A, I_C = 100 mA	$V_{(BR)CEO}$	25	30	—	Volts
Breakdown Voltage C to E	V_{BE} = 0 V, I_C = 100 mA	$V_{(BR)CES}$	55	70	—	Volts
Breakdown Voltage E to B	I_C = 0 A, I_E = 5 mA	$V_{(BR)EBO}$	3.5	5	—	Volts
DC Current Gain	V_{CE} = 5 V, I_C = 1 A	h_{FE}	20	50	100	—

RF Specifications (100% Tested)

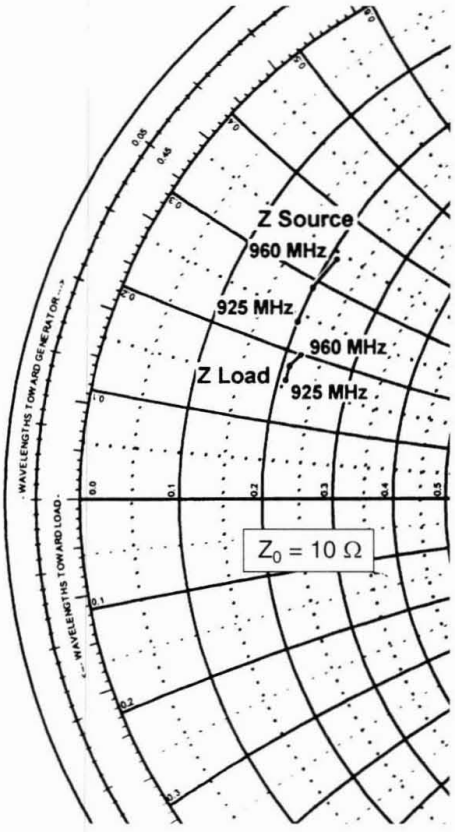
Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{CC} = 26 Vdc, P_{OUT} = 70 W, I_{CQ} = 200 mA, f = 960 MHz)	G_{pe}	8.5	9.5	—	dB
Collector Efficiency (V_{CC} = 26 Vdc, P_{OUT} = 70 W, I_{CQ} = 200 mA, f = 960 MHz)	η_C	50	—	—	%
Intermodulation Distortion (V_{CC} = 26 Vdc, Pout = 50 W(PEP), I_{CQ} = 200 mA, f = 960 MHz)	IMD	—	-31	—	dBc
Load Mismatch Tolerance (V_{CC} = 26 Vdc, P_{OUT} = 50 W(PEP), I_{CQ} = 200 mA, f = 960 MHz—all phase angles at frequency of test)	Ψ	—	—	10:1	—

Impedance Data (data shown for fixed-tuned broadband circuit)

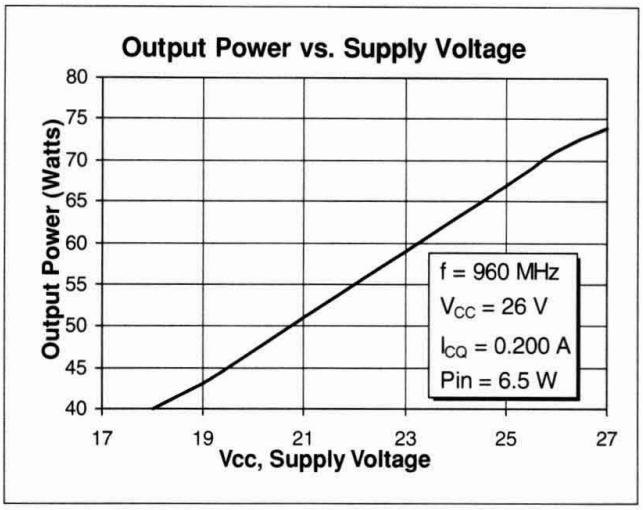
(V_{CC} = 26 Vdc, P_{OUT} = 70 W, I_{CQ} = 200 mA)

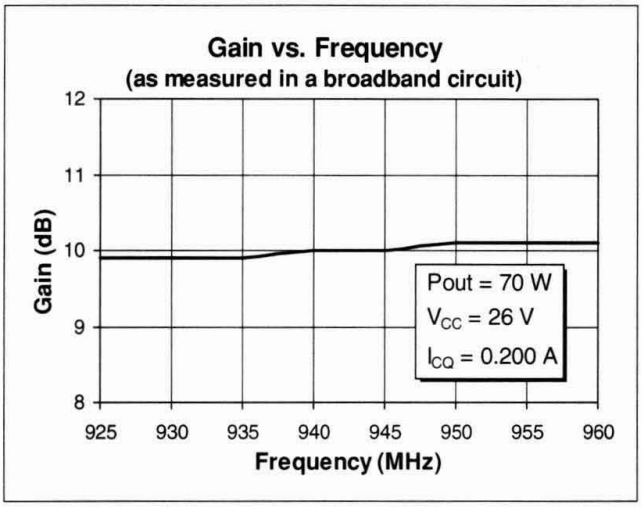


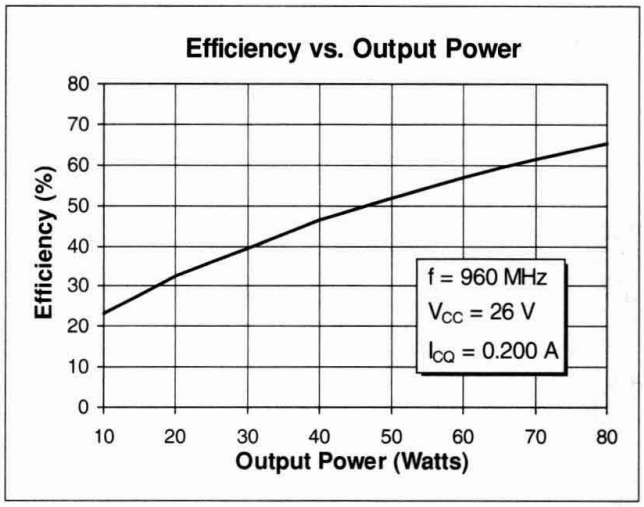
Frequency	Z Source Ω		Z Load Ω	
MHz	R	jX	R	jX
925	2.0	2.4	2.1	1.6
942	2.0	2.9	2.1	1.8
960	2.1	3.4	2.2	2.0

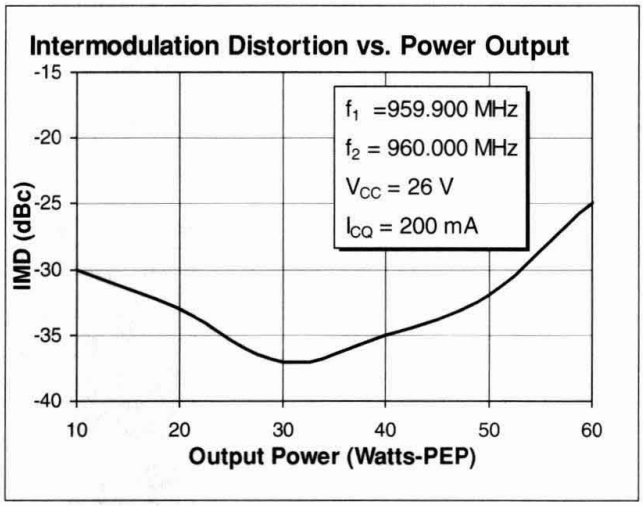


Typical Characteristics

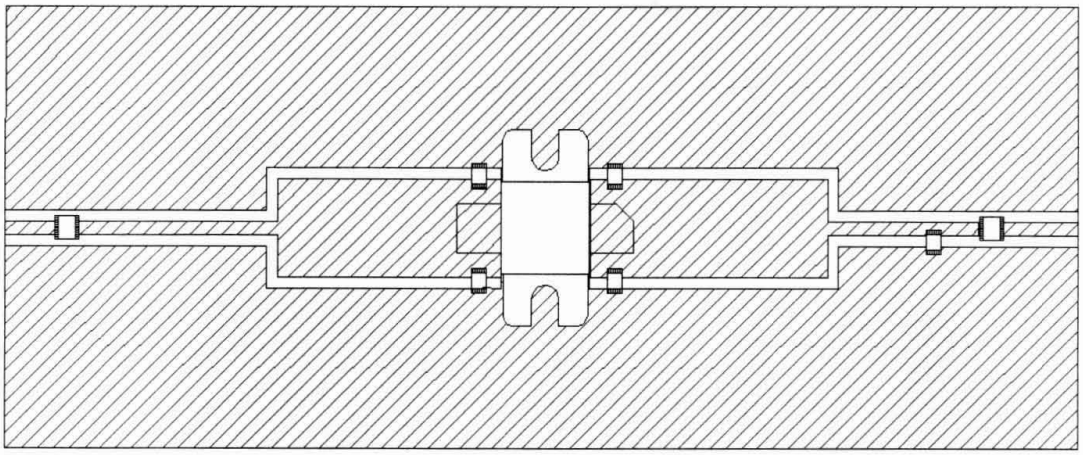






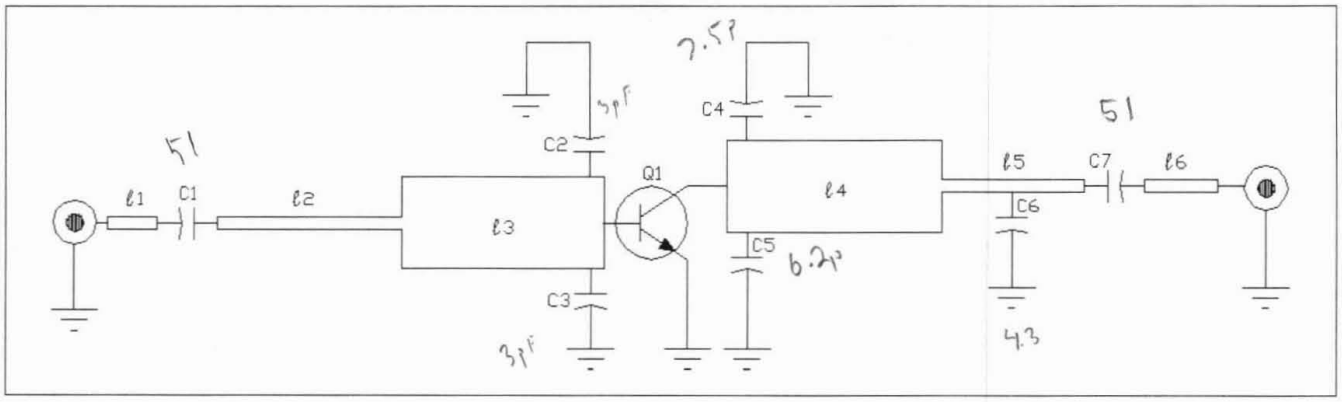


Test Circuit



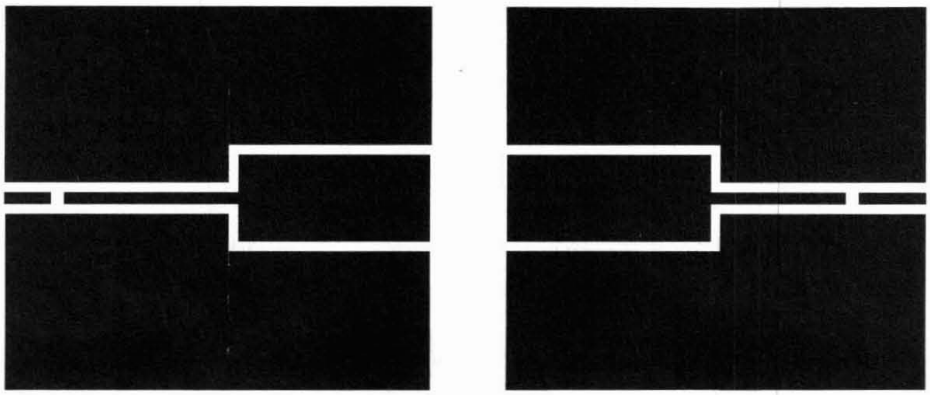
Parts Layout (not to scale)

Test Circuit



Schematic for test circuit

Q1	PTB 20219, NPN RF Transistor
ℓ1–ℓ6	Microstrip (see Artwork detail below)
C1, C7	51 pF, Capacitor ATC 100 B
C2, C3	3.0 pF, Capacitor ATC 100 B
C4	7.5 pF, Capacitor ATC 100 B
C5	6.2 pF, Capacitor ATC 100 B
C6	4.3 pF, Capacitor ATC 100 B
Circuit Board	.031" Thick, G-200, Solid Copper Bottom



Artwork (1 inch ———)

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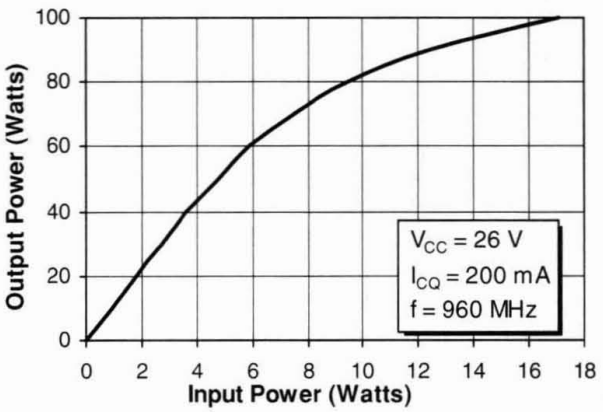
ERICSSON

PTB 20135
85 Watts, 925–960 MHz
Cellular Radio RF Power Transistor

Description

The PTB 20135 is a class AB, NPN, common emitter RF power transistor intended for 26 Vdc operation from 925 to 960 MHz. Rated at 85 watts minimum output power, it may be used for both CW and PEP applications. Ion implantation, nitride surface passivation and gold metallization are used to ensure excellent device reliability. 100% lot traceability is standard.

- 26 Volt, 960 MHz Characteristics
  - Output Power = 85 Watts
  - Collector Efficiency = 50% at 85 Watts
  - IMD = -30 dBc Max at 60 W(PEP)
- Class AB Characteristics
- Gold Metallization
- Silicon Nitride Passivated



Package 20216

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CER}	40	Vdc
Collector-Base Voltage	V_{CBO}	65	Vdc
Emitter-Base Voltage (collector open)	V_{EBO}	4.0	Vdc
Collector Current (continuous)	I_C	20	Adc
Total Device Dissipation at T_{flange} = 25°C Above 25°C derate by	P_D	165 0.95	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{flange} = 70°C)	$R_{\theta JC}$	1.06	°C/W

PTB 20135

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Electrical Characteristics (100% Tested)

Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Breakdown Voltage C to E	I_B = 0 A, I_C = 100 mA	$V_{(BR)CEO}$	25	30	—	Volts
Breakdown Voltage C to E	V_{BE} = 0 V, I_C = 100 mA	$V_{(BR)CES}$	55	70	—	Volts
Breakdown Voltage E to B	I_C = 0 A, I_E = 5 mA	$V_{(BR)EBO}$	3.5	5	—	Volts
DC Current Gain	V_{CE} = 5 V, I_C = 1 A	h_{FE}	20	50	100	—

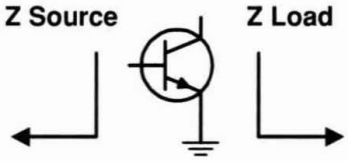
RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{CC} = 26 Vdc, P_{OUT} = 85 W, I_{CQ} = 200 mA, f = 960 MHz)	G_{pe}	8.0	9.5	—	dB
Collector Efficiency (V_{CC} = 26 Vdc, P_{OUT} = 85 W, I_{CQ} = 200 mA, f = 960 MHz)	η_C	50	—	—	%
Intermodulation Distortion (V_{CC} = 26 Vdc, P_{OUT} = 60 W(PEP), I_{CQ} = 200 mA, f_1 = 959.95 MHz, f_2 = 960.00 MHz)	IMD	—	-31	—	dBc
Load Mismatch Tolerance (V_{CC} = 26 Vdc, P_{OUT} = 60 W(PEP), I_{CQ} = 200 mA, f = 960 MHz—all phase angles at frequency of test)	Ψ	—	—	10:1	—

3

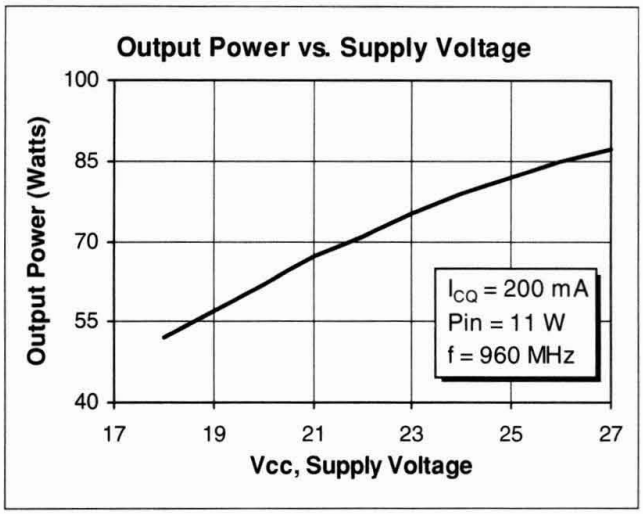
Impedance Data (data shown for fixed-tuned broadband circuit)

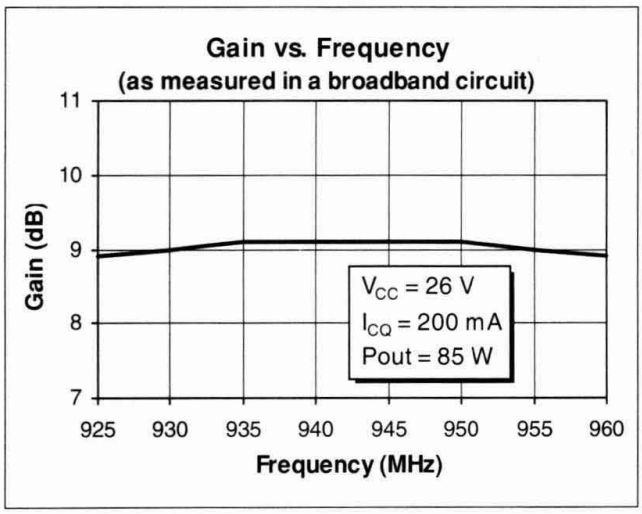
(V_{CC} = 26 Vdc, P_{OUT} = 85 W, I_{CQ} = 200 mA)

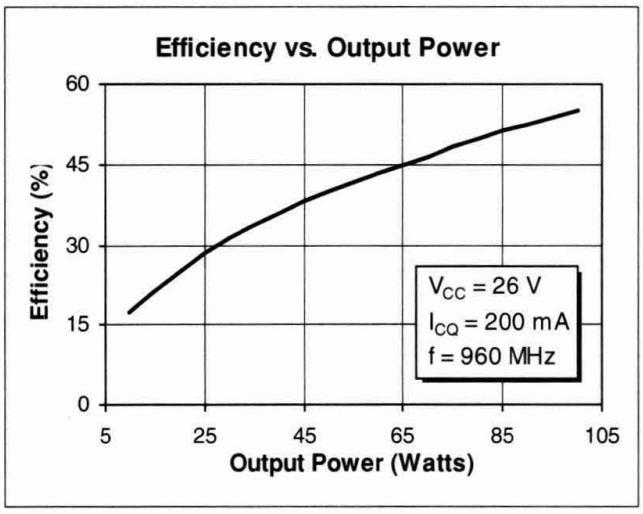


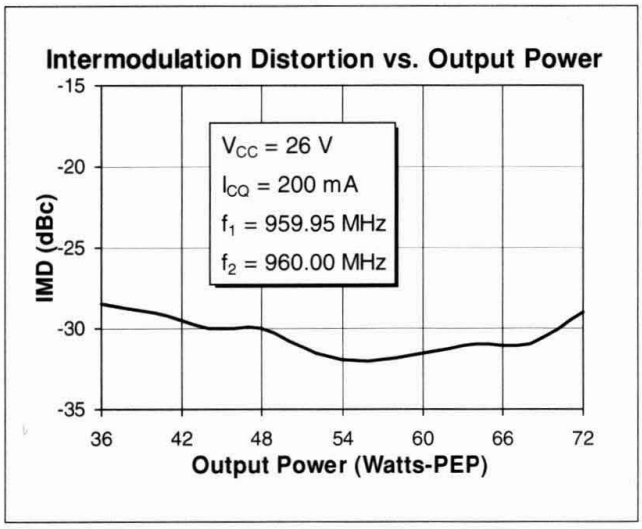
Frequency	Z Source Ω		Z Load Ω	
MHz	R	jX	R	jX
925	3.0	-1.0	1.4	0.1
942	2.7	-0.7	1.4	-0.2
960	2.6	-0.4	1.4	0.2

Typical Performance









3

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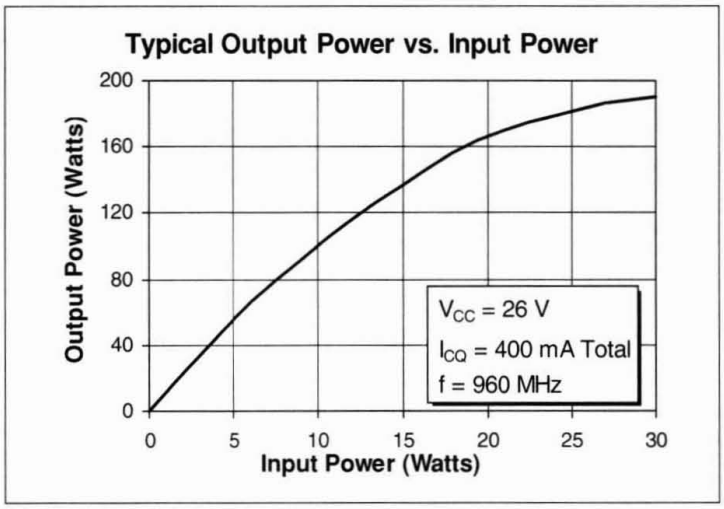
ERICSSON

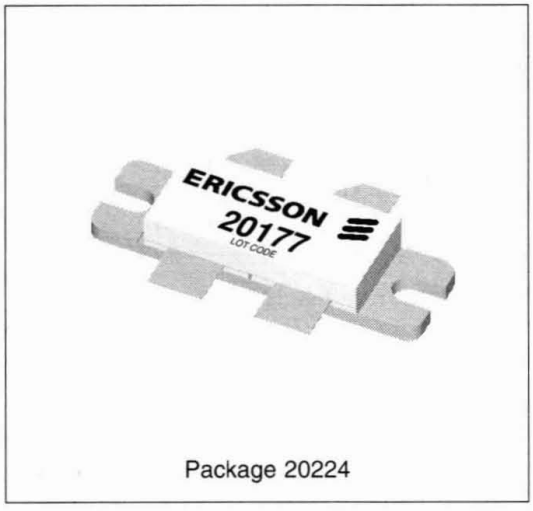
PTB 20177
150 Watts, 925–960 MHz
Cellular Radio RF Power Transistor

Description

The PTB 20177 is a class AB, NPN, common emitter RF power transistor intended for 26 Vdc operation from 925 to 960 MHz. Rated at 150 watts minimum output power, it may be used for both CW and PEP applications. Ion implantation, nitride surface passivation and gold metallization are used to ensure excellent device reliability. 100% lot traceability is standard.

- 26 Volt, 960 MHz Characteristics
  - Output Power = 150 Watts (PEP)
  - Collector Efficiency = 50 Min at 150 Watts
  - IMD = -28 dBc Max at 150 Watts (PEP)
- Class AB Characteristics
- Gold Metallization
- Silicon Nitride Passivated





Package 20224

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage (1)	V_{CER}	40	Vdc
Collector-Base Voltage (1)	V_{CBO}	60	Vdc
Emitter-Base Voltage (collector open)	V_{EBO}	4.0	Vdc
Collector Current (continuous)	I_C	25.0	Adc
Total Device Dissipation at T_{flange} = 25°C Above 25°C derate by	P_D	330 1.89	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{flange} = 70°C)	$R_{\theta JC}$	0.53	°C/W

(1) per side

Electrical Characteristics (100% Tested—characteristics, conditions and limits shown per side)

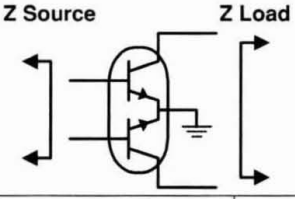
Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Breakdown Voltage C to E	I_B = 0 A, I_C = 100 mA	$V_{(BR)CEO}$	25	30	—	Volts
Breakdown Voltage C to E	V_{BE} = 0 V, I_C = 100 mA	$V_{(BR)CES}$	55	70	—	Volts
Breakdown Voltage E to B	I_C = 0 A, I_E = 5 mA	$V_{(BR)EBO}$	3.5	5	—	Volts
DC Current Gain	V_{CE} = 5 V, I_C = 1 A	h_{FE}	20	50	100	—

RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{CC} = 26 Vdc, P_{OUT} = 150 W, I_{CQ} = 400 mA Total, f = 960 MHz)	G_{pe}	7.5	8.5	—	dB
Gain at PEP (V_{CC} = 26 Vdc, P_{OUT} = 150 W(PEP), I_{CQ} = 400 mA Total, f = 960 MHz)	G_{pe}	8	9	—	dB
Collector Efficiency (V_{CC} = 26 Vdc, P_{OUT} = 150 W, I_{CQ} = 400 mA Total, f = 960 MHz)	η_C	50	—	—	%
Collector Efficiency at PEP (V_{CC} = 26 Vdc, P_{out} = 150 W(PEP), I_{CQ} = 400 mA Total, f = 960 MHz)	η_C	35	—	—	%
Intermodulation Distortion (V_{CC} = 26 Vdc, P_{out} = 150 W(PEP), I_{CQ} = 400 mA Total, f_1 = 959.9 MHz, f_2 = 960.0 MHz)	IMD	—	-30	-28	dBc
Load Mismatch Tolerance (V_{CC} = 26 Vdc, P_{OUT} = 150 W(PEP), I_{CQ} = 400 mA Total, f = 960 MHz—all phase angles at frequency of test)	Ψ	—	—	5:1	—

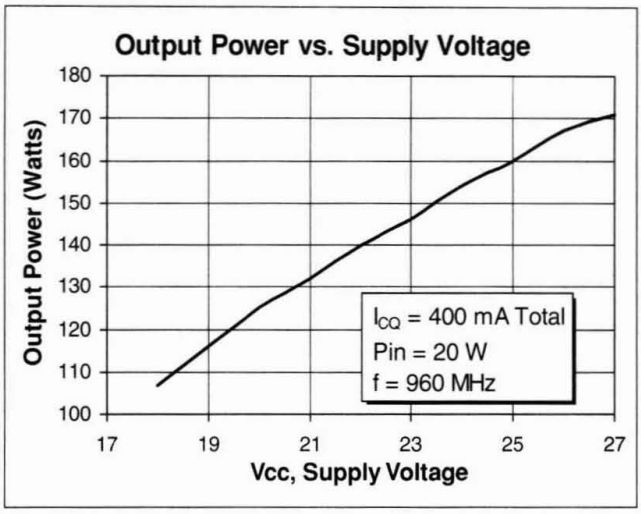
Impedance Data (data shown for fixed-tuned broadband circuit)

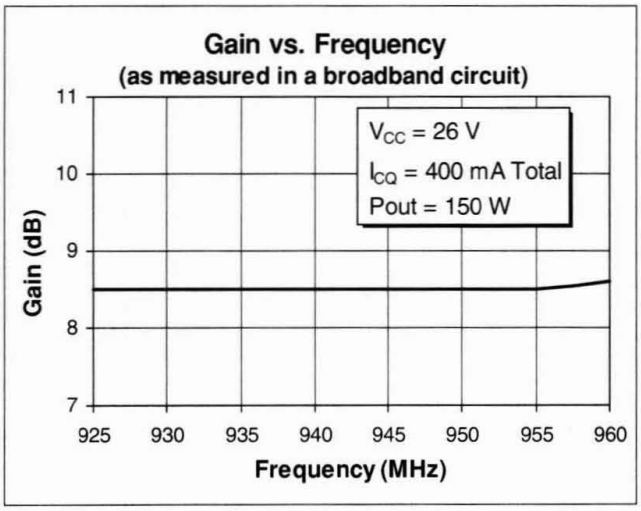
(V_{CC} = 26 Vdc, P_{OUT} = 150 W, I_{CQ} = 400 mA Total)

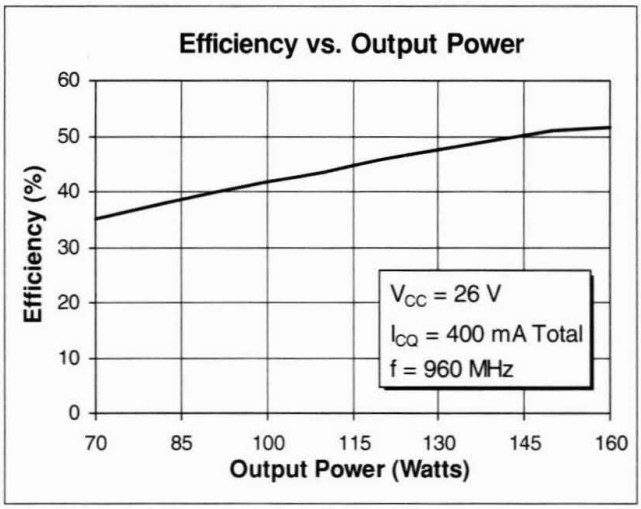


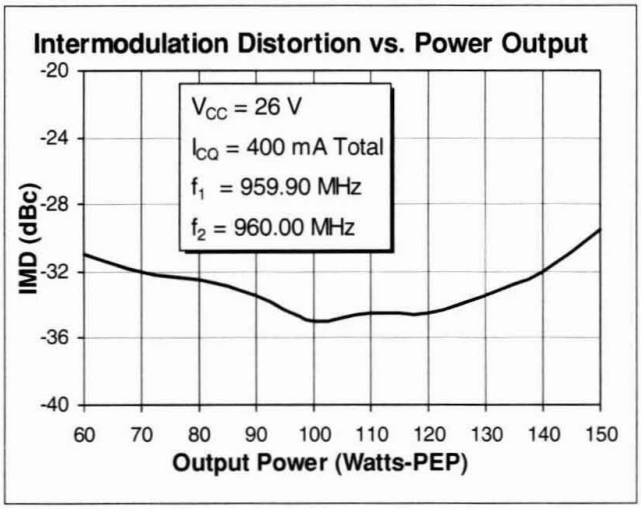
Frequency	Z Source Ω		Z Load Ω	
MHz	R	jX	R	jX
925	4.3	-3.6	3.8	-1.8
940	4.1	-3.6	3.5	-1.4
960	3.7	-3.4	3.1	-0.9

Typical Performance









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ERICSSON

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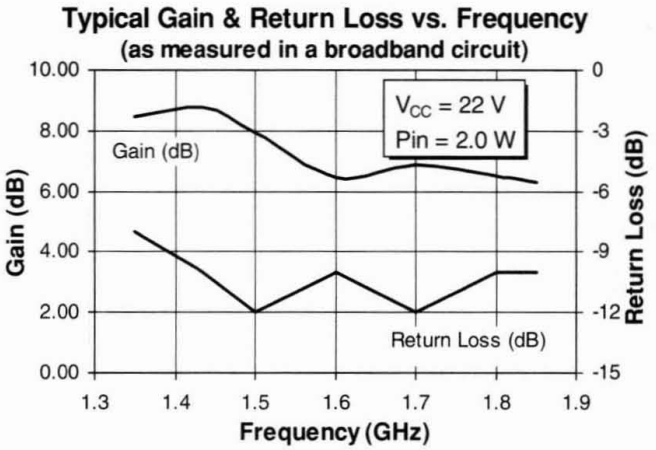
ERICSSON

PTB 20156
8 Watts, 1350–1850 MHz
Microwave Power Transistor

Description

The PTB 20156 is an NPN, common base RF power transistor intended for 22 Vdc operation from 1350 to 1850 MHz. Rated at 8 watts minimum output power, it may be used for both CW and PEP applications. Ion implantation, nitride surface passivation and gold metallization are used to ensure excellent device reliability. 100% lot traceability is standard.

- Specified 22 Volts
- Class C Characteristics
- Output Power: 8 Watts
- Gain: 6.0 dB Min. at 8 Watts
- Gold Metallization
- Silicon Nitride Passivated



Package 20209

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-Base Voltage	V_{CBO}	50	Vdc
Emitter-Base Voltage (collector open)	V_{EBO}	4.0	Vdc
Collector Current (continuous)	I_C	2.0	Adc
Total Device Dissipation at T_{flange} = 25°C Above 25°C derate by	P_D	52 0.29	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{flange} = 70°C)	$R_{\theta JC}$	3.4	°C/W

Electrical Characteristics (100% Tested)

Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Breakdown Voltage C to E	V_{BE} = 0 V, I_C = 5 mA	$V_{(BR)CES}$	50	—	—	Volts
Breakdown Voltage E to B	I_C = 0 A, I_E = 5 mA	$V_{(BR)EBO}$	3.5	5	—	Volts
DC Current Gain	V_{CE} = 5 V, I_C = 1 A	h_{FE}	—	—	100	—

RF Specifications (100% Tested)

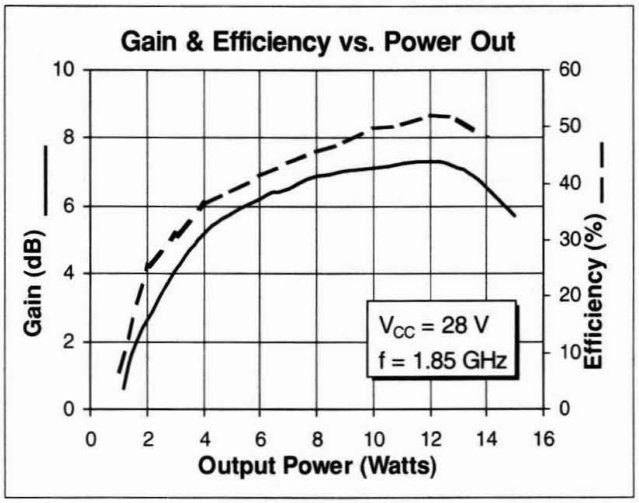
Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{CC} = 22 Vdc, P_{OUT} = 8 W, f = 1850 MHz)	G_{pe}	6.0	—	—	dB
Collector Efficiency (V_{CC} = 22 Vdc, P_{OUT} = 8 W, f = 1850 MHz)	η_C	40	50	—	%
Load Mismatch Tolerance (V_{CC} = 22 Vdc, P_{OUT} = 8 W, f = 1850 MHz —all phase angles at frequency of test)	Ψ	—	—	5:1	—

Impedance Data (data shown for fixed-tuned broadband circuit)

(V_{CC} = 22 Vdc, P_{OUT} = 20 W)

Frequency	Z Source Ω		Z Load Ω	
MHz	R	jX	R	jX
1350	13.8	-14.0	4.2	0.0
1500	11.2	-12.8	5.6	0.5
1700	10.7	-8.4	6.0	-1.5
1850	20.0	-9.3	4.2	-2.1

Typical Performance



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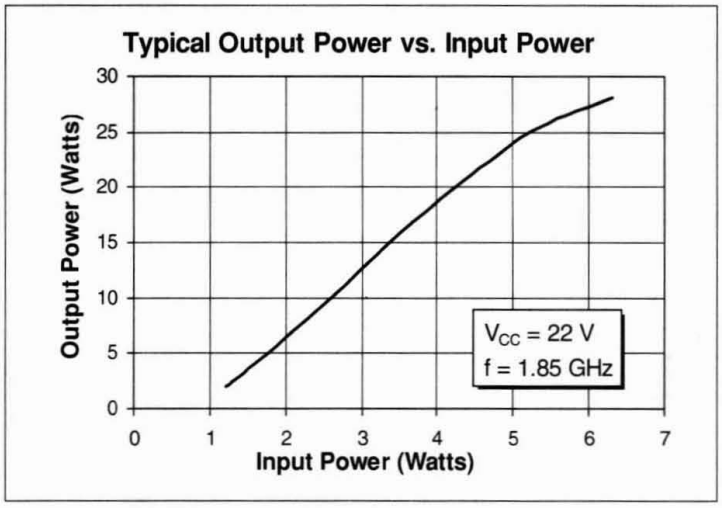
ERICSSON

PTB 20157
20 Watts, 1.35–1.85 GHz
RF Power Transistor

Description

The PTB 20157 is an NPN common base RF power transistor intended for 22–26 Vdc class C operation from 1.35 to 1.85 GHz. Rated at 20 watts minimum output power, it may be used for both CW and PEP applications. Ion implantation, nitride surface passivation and gold metallization are used to ensure excellent device reliability. 100% lot traceability is standard.

- 20 Watts, 1.35–1.85 GHz
- Class C Characteristics
- 40% Min Collector Efficiency at 20 Watts
- Gold Metallization
- Silicon Nitride Passivated



Package 20209

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CER}	50	Vdc
Collector-Base Voltage	V_{CBO}	50	Vdc
Emitter-Base Voltage (collector open)	V_{EBO}	4	Vdc
Collector Current (continuous)	I_C	6	Adc
Total Device Dissipation at T_{flange} = 25°C Above 25°C derate by	P_D	75 0.43	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{flange} = 70°C)	$R_{\theta JC}$	2.33	°C/W

3

Electrical Characteristics (100% Tested)

Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Breakdown Voltage C to E	I_C = 50 mA, R_{BE} = 27 Ω	$V_{(BR)CER}$	50	—	—	Volts
Breakdown Voltage C to E	V_{BE} = 0 V, I_C = 50 mA	$V_{(BR)CES}$	50	—	—	Volts
Breakdown Voltage E to B	I_C = 0 A, I_E = 5 mA	$V_{(BR)EBO}$	4	5	—	Volts
DC Current Gain	V_{CE} = 5 V, I_C = 500 mA	h_{FE}	20	50	120	—

RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{CC} = 22 Vdc, P_{OUT} = 20 W, f = 1.85 GHz)	G_{pe}	6	7	—	dB
Collector Efficiency (V_{CC} = 22 Vdc, P_{OUT} = 20 W, f = 1.85 GHz)	η_C	40	43	—	%
Load Mismatch Tolerance (V_{CC} = 22 Vdc, P_{OUT} = 20 W, f = 1.85 GHz —all phase angles at frequency of test)	Ψ	—	—	10:1	—

Impedance Data (data shown for fixed-tuned broadband circuit)

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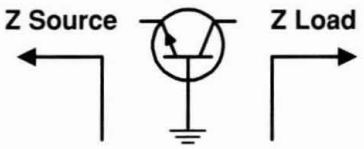
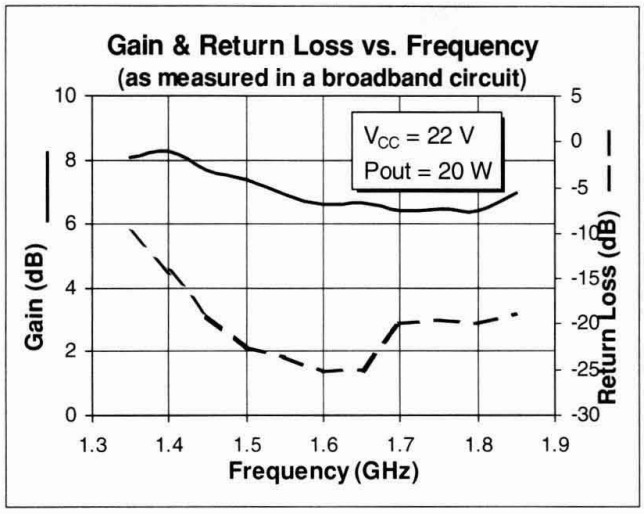
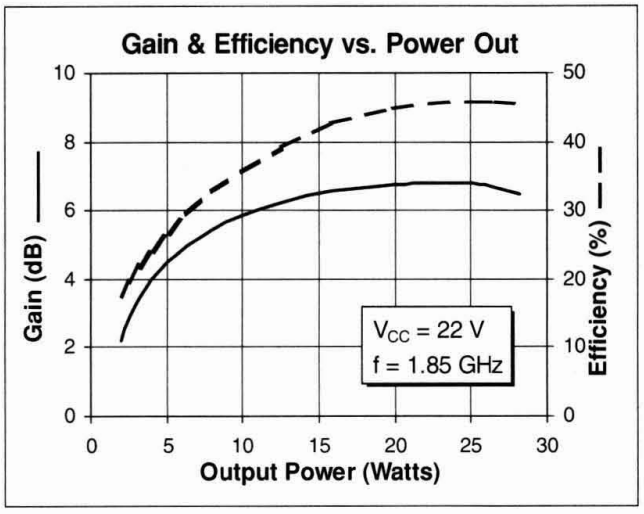
(V_{CC} = 22 Vdc, P_{OUT} = 20 W)



Frequency	Z Source Ω		Z Load Ω	
GHz	R	jX	R	jX
1.350	8.2	-15.0	9.3	-15
1.400	7.7	-13.0	8.8	-15
1.450	7.4	-12.0	8.3	-14
1.500	7.3	-11.0	7.9	-14
1.550	7.2	-10.0	7.5	-13
1.600	7.3	-9.2	7.2	-13
1.650	7.4	-8.6	6.9	-13
1.700	7.6	-8.1	6.6	-12
1.750	7.9	-7.8	6.4	-12
1.800	8.1	-7.6	6.2	-11
1.850	8.4	-7.5	6.1	-11

Typical Performance





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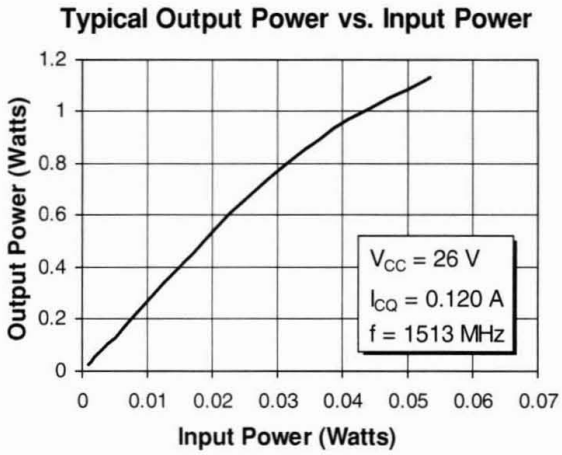
ERICSSON

PTB 20248
0.7 Watts, 1465–1513 MHz
Cellular Radio RF Power Transistor

Description

The PTB 20248 is a class A, NPN, common emitter RF power transistor intended for 26 Vdc operation from 1465 to 1513 MHz. Rated at 0.7 watts minimum output power, it may be used for both CW and PEP applications. Ion implantation, nitride surface passivation and gold metallization are used to ensure excellent device reliability. 100% lot traceability is standard.

- 0.7 Watts, 26 Vdc
- Class A Characteristics
- Surface Mountable
- Available in Tape and Reel
- Gold Metallization
- Silicon Nitride Passivated



Package 20227

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CER}	55	Vdc
Collector-Base Voltage	V_{CBO}	55	Vdc
Emitter-Base Voltage (collector open)	V_{EBO}	4	Vdc
Collector Current (continuous)	I_C	0.5	Adc
Total Device Dissipation at T_{flange} = 25°C Above 25°C derate by	P_D	5.4 0.031	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{flange} = 70°C)	$R_{\theta JC}$	32.3	°C/W

PTB 20248

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Electrical Characteristics (100% Tested)

Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Breakdown Voltage C to E	I_B = 0 A, I_C = 5 mA, R_{BE} = 22 Ω	$V_{(BR)CER}$	55	—	—	Volts
Breakdown Voltage C to E	V_{BE} = 0 V, I_C = 5 mA	$V_{(BR)CES}$	55	—	—	Volts
Breakdown Voltage E to B	I_C = 0 A, I_E = 5 mA	$V_{(BR)EBO}$	4	5	—	Volts
DC Current Gain	V_{CE} = 5 V, I_C = 200 mA	h_{FE}	20	—	—	—

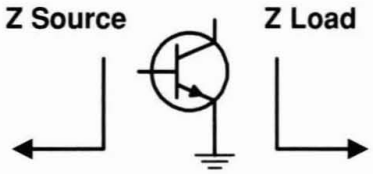
RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{CC} = 26 Vdc, P_{OUT} = 0.2 W, I_{CQ} = 120 mA, f = 1513 MHz)	G_{pe}	10	12	—	dB
Power Output at 1 dB Compression (V_{CC} = 26 Vdc, I_{CQ} = 120 mA, f = 1513 MHz)	P-1dB	0.7	0.9	—	Watts
Load Mismatch Tolerance (V_{CC} = 26 Vdc, P_{OUT} = 0.7 W, I_{CQ} = 120 mA, f = 1513 MHz —all phase angles at frequency of test)	Ψ	—	—	5:1	—

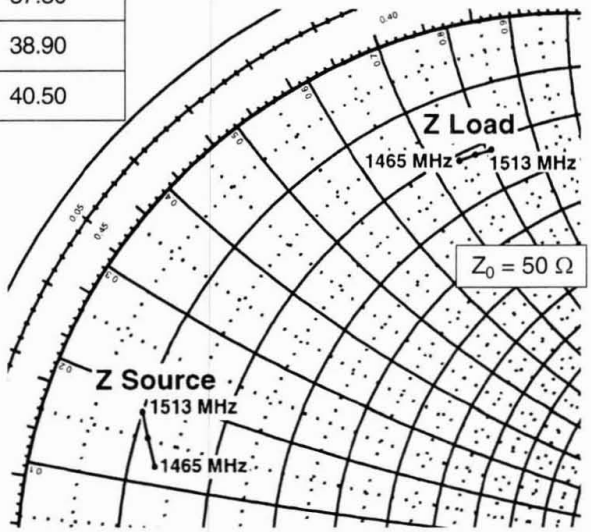
Impedance Data (data shown for fixed-tuned broadband circuit)

3

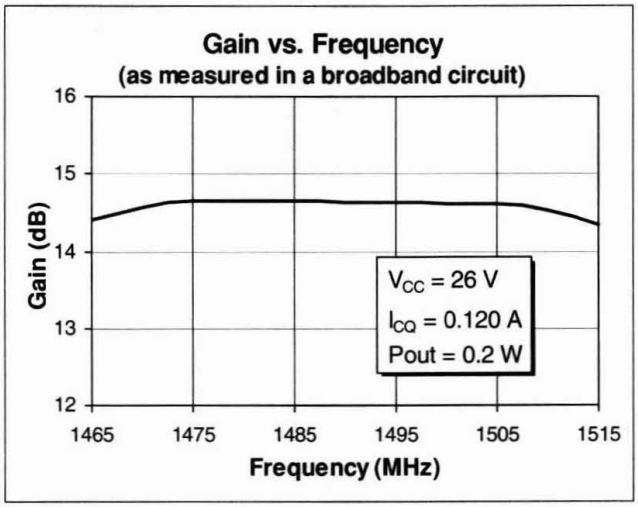
(V_{CC} = 26 Vdc, P_{out} = 0.7 W, I_{CQ} = 120 mA)



Frequency	Z Source Ω		Z Load Ω	
MHz	R	jX	R	jX
1465	6.50	6.10	10.60	37.30
1489	5.70	7.60	10.70	38.90
1513	5.00	8.90	10.90	40.50



Typical Performance



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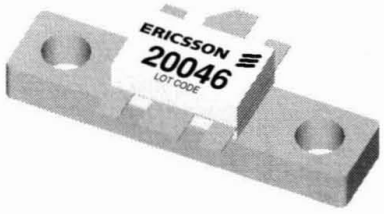
PTB 20046
1 Watt, 1465–1513 MHz
Cellular Radio RF Power Transistor

Description

The PTB 20046 is a class AB, NPN, common emitter RF power transistor intended for 26 Vdc operation from 1465 to 1501 MHz. Rated at 1 watt minimum output power, it may be used for both CW and PEP applications. Ion implantation, nitride surface passivation and gold metallization are used to ensure excellent device reliability. 100% lot traceability is standard.

- 1 Watt, 1465–1513 MHz
- Class AB Characteristics
- 18% Collector Efficiency at 1 Watt
- Gold Metallization
- Silicon Nitride Passivated



Package 20201

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Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CER}	50	Vdc
Collector-Base Voltage	V_{CBO}	50	Vdc
Emitter-Base Voltage (collector open)	V_{EBO}	4.0	Vdc
Collector Current (continuous)	I_C	0.7	Adc
Total Device Dissipation at T_{flange} = 25°C Above 25°C derate by	P_D	10 0.057	Watts W/°C
Storage Temperature	T_{stg}	150	°C
Thermal Resistance (T_{flange} = 70°C)	$R_{\theta JC}$	17.5	°C/W

PTB 20046

ERICSSON

Electrical Characteristics (100% Tested)

Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Breakdown Voltage C to E	I_B = 0 A, I_C = 10 mA, R_{BE} = 22 Ω	$V_{(BR)CER}$	50	—	—	Volts
Breakdown Voltage C to E	V_{BE} = 0 V, I_C = 10 mA	$V_{(BR)CES}$	50	—	—	Volts
Breakdown Voltage E to B	I_C = 0 A, I_E = 5 mA	$V_{(BR)EBO}$	4	5	—	Volts
DC Current Gain	V_{CE} = 5 V, I_C = 1 A	h_{FE}	20	50	120	—

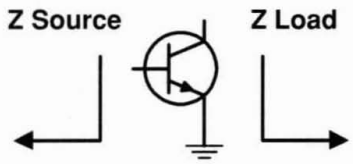
RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{CC} = 26 Vdc, P_{out} = 1 W, I_{CQ} = 40 mA, f = 1501 MHz)	G_{pe}	10.5	—	—	dB
Power Output at 1 dB Compression (V_{CC} = 26 Vdc, I_{CQ} = 40 mA, f = 1501 MHz)	P-1dB	2.5	—	—	Watts
Collector Efficiency (V_{CC} = 26 Vdc, P_{OUT} = 1 W, I_{CQ} = 40 mA, f = 1501 MHz)	η_C	18	—	—	%
Intermodulation Distortion (V_{CC} = 26 Vdc, P_{OUT} = 1 W(PEP), I_{CQ} = 40 mA, f_1 = 1500 MHz, f_2 = 1501 MHz)	IMD	—	-23	—	dBc
Load Mismatch Tolerance (V_{CC} = 26 Vdc, P_{OUT} = 1 W, I_{CQ} = 40 mA, f = 1501 MHz—all phase angles at frequency of test)	Ψ	—	—	5:1	—

3

Impedance Data (data shown for fixed-tuned broadband circuit)

(V_{CC} = 26 Vdc, P_{OUT} = 1 W, I_{CQ} = 40 mA)



Frequency	Z Source Ω		Z Load Ω	
MHz	R	jX	R	jX
1477	10.42	-1.49	8.69	15.67
1489	10.20	-1.26	8.84	16.01
1501	9.87	-1.05	9.08	16.44

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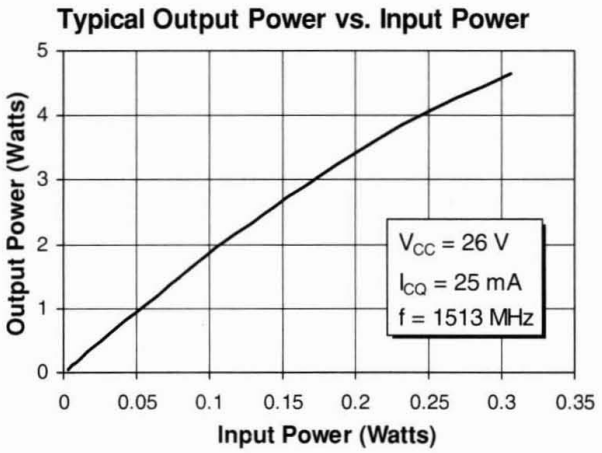
ERICSSON

PTB 20249
2.5 Watts, 1465–1513 MHz
Cellular Radio RF Power Transistor

Description

The PTB 20249 is a class AB, NPN, common emitter RF power transistor intended for 26 Vdc operation from 1465 to 1513 MHz. Rated at 2.5 watts minimum output power, it may be used for both CW and PEP applications. Ion implantation, nitride surface passivation and gold metallization are used to ensure excellent device reliability. 100% lot traceability is standard.

- 2.5 Watts, 26 Vdc
- Class AB Characteristics
- Surface Mountable
- Available in Tape and Reel
- Gold Metallization
- Silicon Nitride Passivated



Package 20227

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CER}	55	Vdc
Collector-Base Voltage	V_{CBO}	55	Vdc
Emitter-Base Voltage (collector open)	V_{EBO}	4	Vdc
Collector Current (continuous)	I_C	0.5	Adc
Total Device Dissipation at T_{flange} = 25°C Above 25°C derate by	P_D	10 0.057	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{flange} = 70°C)	$R_{\theta JC}$	17.5	°C/W

Electrical Characteristics (100% Tested)

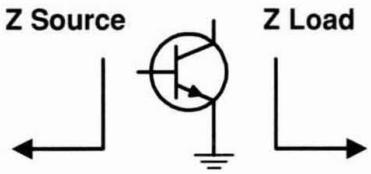
Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Breakdown Voltage C to E	I_B = 0 A, I_C = 5 mA, R_{BE} = 22 Ω	$V_{(BR)CER}$	55	—	—	Volts
Breakdown Voltage C to E	V_{BE} = 0 V, I_C = 5 mA	$V_{(BR)CES}$	55	—	—	Volts
Breakdown Voltage E to B	I_C = 0 A, I_E = 5 mA	$V_{(BR)EBO}$	4	5	—	Volts
DC Current Gain	V_{CE} = 5 V, I_C = 250 mA	h_{FE}	20	—	—	—

RF Specifications (100% Tested)

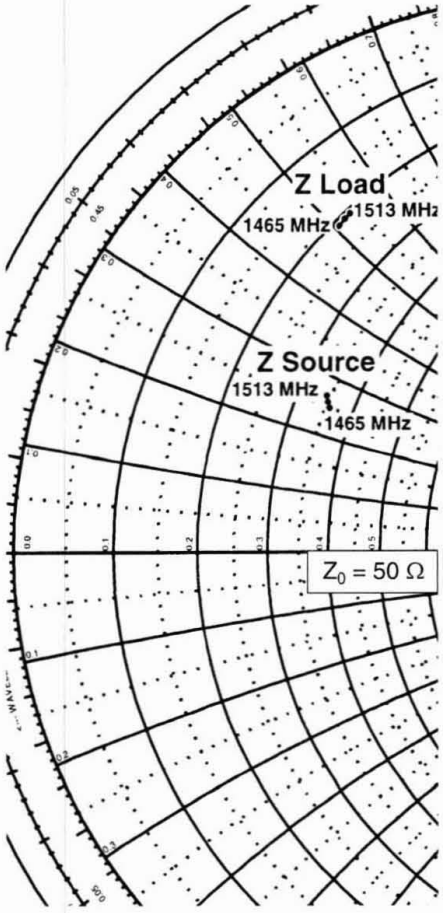
Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{CC} = 26 Vdc, P_{OUT} = 1 W, I_{CQ} = 25 mA, f = 1513 MHz)	G_{pe}	9.5	11.5	—	dB
Power Output at 1 dB Compression (V_{CC} = 26 Vdc, I_{CQ} = 25 mA, f = 1513 MHz)	P-1dB	2.5	3.5	—	Watts
Load Mismatch Tolerance (V_{CC} = 26 Vdc, P_{OUT} = 5 W, I_{CQ} = 25 mA, f = 1513 MHz—all phase angles at frequency of test)	Ψ	—	—	5:1	—

Impedance Data (data shown for fixed-tuned broadband circuit)

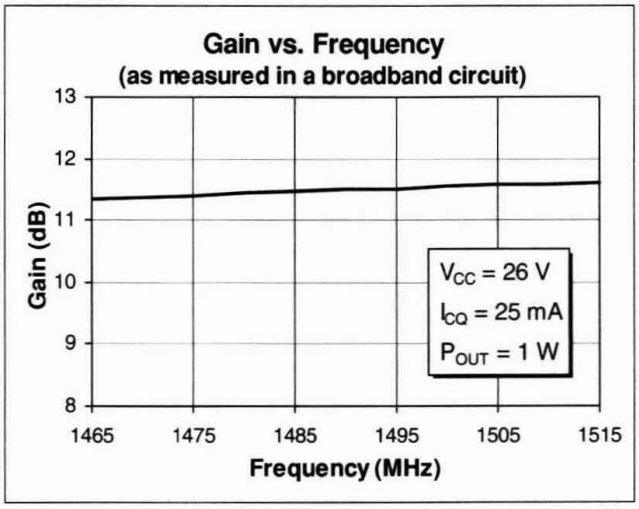
(V_{CC} = 26 Vdc, P_{OUT} = 2.5 W, I_{CQ} = 25 mA)



Frequency	Z Source Ω		Z Load Ω	
MHz	R	jX	R	jX
1465	17.90	12.50	10.50	25.40
1489	17.60	12.90	10.40	26.10
1513	17.30	13.40	10.40	26.70



Typical Performance



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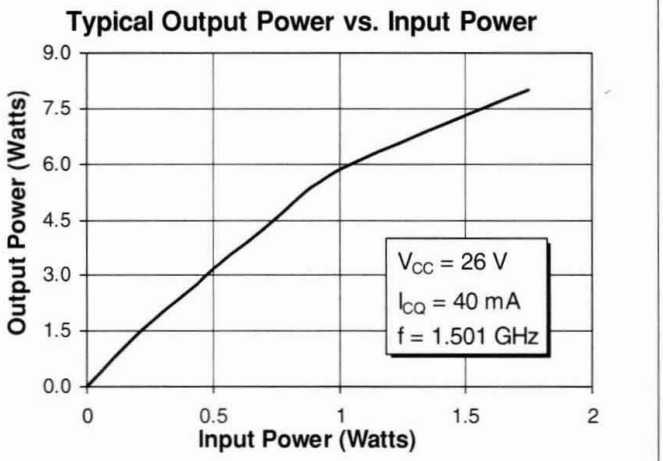
ERICSSON

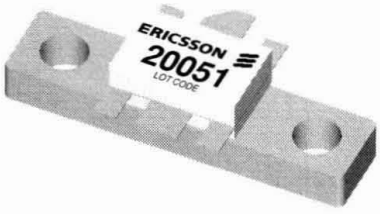
PTB 20051
6 Watts, 1.465–1.513 GHz
Cellular Radio RF Power Transistor

Description

The PTB 20051 is a class AB, NPN, common emitter RF power transistor intended for 26 Vdc operation from 1.465 to 1.513 GHz. Rated at 6 watts minimum output power, it may be used for both CW and PEP applications. Ion implantation, nitride surface passivation and gold metallization are used to ensure excellent device reliability. 100% lot traceability is standard.

- 6 Watts, 1.465–1.513 GHz
- Class AB Characteristics
- 35% Collector Efficiency at 4 Watts
- Gold Metallization
- Silicon Nitride Passivated





Package 20201

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Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CER}	50	Vdc
Collector-Base Voltage	V_{CBO}	50	Vdc
Emitter-Base Voltage (collector open)	V_{EBO}	4.0	Vdc
Collector Current (continuous)	I_C	0.7	Adc
Total Device Dissipation at T_{flange} = 25°C Above 25°C derate by	P_D	28 0.16	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{flange} = 70°C)	$R_{\theta JC}$	6.2	°C/W

Electrical Characteristics (100% Tested)

Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Breakdown Voltage C to E	I_B = 0 A, I_C = 10 mA, R_{BE} = 22 Ω	$V_{(BR)CER}$	50	—	—	Volts
Breakdown Voltage C to E	V_{BE} = 0 V, I_C = 10 mA	$V_{(BR)CES}$	50	—	—	Volts
Breakdown Voltage E to B	I_C = 0 A, I_E = 5 mA	$V_{(BR)EBO}$	4	5	—	Volts
DC Current Gain	V_{CE} = 10 V, I_C = 0.7 A	h_{FE}	20	50	120	—

RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{CC} = 26 Vdc, P_{OUT} = 4 W, I_{CQ} = 40 mA, f = 1.501 GHz)	G_{pe}	8.0	—	—	dB
Power Output at 1 dB Compression (V_{CC} = 26 Vdc, I_{CQ} = 40 mA, f = 1.501 GHz)	P-1dB	6.5	—	—	Watts
Collector Efficiency (V_{CC} = 26 Vdc, P_{OUT} = 4 W, I_{CQ} = 40 mA, f = 1.501 GHz)	η_C	35	—	—	%
Load Mismatch Tolerance (V_{CC} = 26 Vdc, P_{OUT} = 4 W, I_{CQ} = 40 mA, f = 1.501 GHz—all phase angles at frequency of test)	Ψ	—	—	5:1	—

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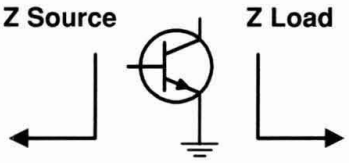
Impedance Data (data shown for fixed-tuned broadband circuit)

(V_{CC} = 26 Vdc, P_{OUT} = 4 W, I_{CQ} = 40 mA)



Frequency	Z Source Ω		Z Load Ω	
GHz	R	jX	R	jX
1.465	10.7	11.2	11.9	21.0
1.489	9.4	11.8	10.2	20.3
1.513	8.1	12.8	9.7	18.3

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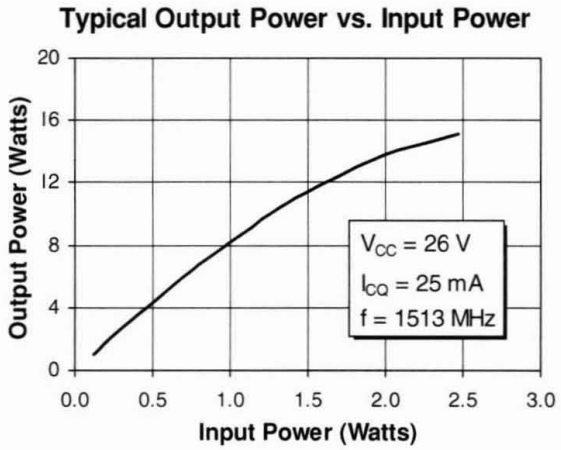
ERICSSON

PTB 20239
12 Watts, 1465–1513 MHz
Cellular Radio RF Power Transistor

Description

The PTB 20239 is a class AB, NPN, common emitter RF power transistor intended for 26 Vdc operation from 1465 to 1513 MHz. Rated at 12 watts minimum output power, it may be used for both CW and PEP applications. Ion implantation, nitride surface passivation and gold metallization ensure excellent device reliability. 100% lot traceability is standard.

- 12 Watts, 26 Vdc
- Class AB Characteristics
- Surface Mountable
- Available in Tape and Reel
- Gold Metallization
- Silicon Nitride Passivated



Package 20232

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CER}	50	Vdc
Collector-Base Voltage	V_{CBO}	50	Vdc
Emitter-Base Voltage (collector open)	V_{EBO}	4	Vdc
Collector Current (continuous)	I_C	2.0	Adc
Total Device Dissipation at T_{flange} = 25°C Above 25°C derate by	P_D	33 0.189	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{flange} = 70°C)	$R_{\theta JC}$	5.3	°C/W

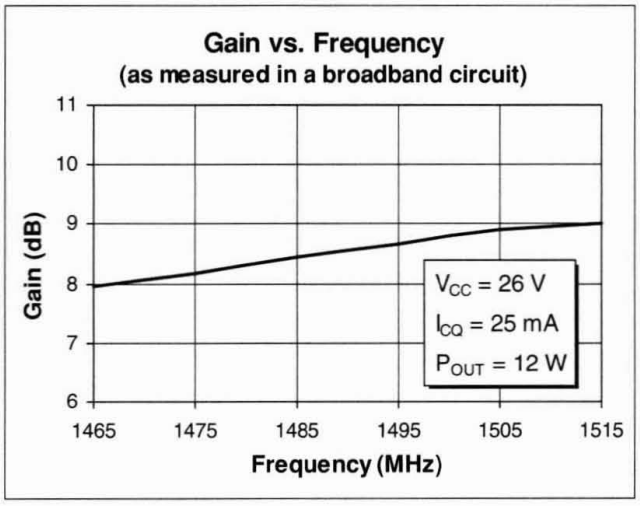
Electrical Characteristics (100% Tested)

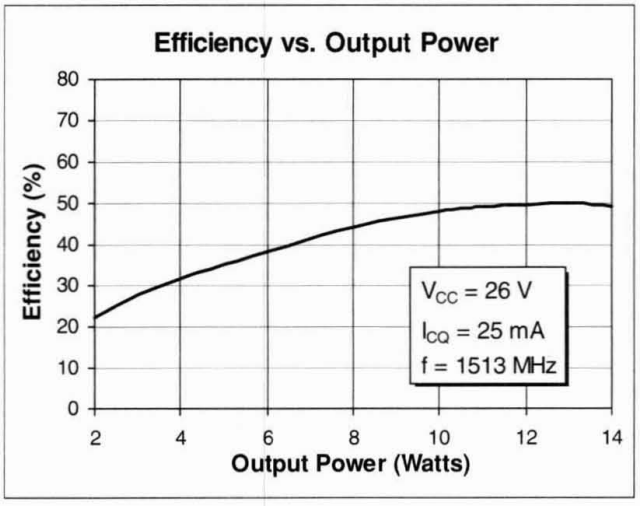
Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Breakdown Voltage C to E	I_B = 0 A, I_C = 5 mA, R_{BE} = 22 Ω	$V_{(BR)CER}$	50	—	—	Volts
Breakdown Voltage C to E	V_{BE} = 0 V, I_C = 5 mA	$V_{(BR)CES}$	50	—	—	Volts
Breakdown Voltage E to B	I_C = 0 A, I_E = 5 mA	$V_{(BR)EBO}$	4	5	—	Volts
DC Current Gain	V_{CE} = 5 V, I_C = 250 mA	h_{FE}	20	—	—	—

RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{CC} = 26 Vdc, P_{OUT} = 10 W, I_{CQ} = 25 mA, f = 1513 MHz)	G_{pe}	8	—	—	dB
Power Output at 1 dB Compression (V_{CC} = 26 Vdc, I_{CQ} = 25 mA, f = 1513 MHz)	P-1dB	12	13	—	Watts
Collector Efficiency (V_{CC} = 26 Vdc, P_{OUT} = 12 W, I_{CQ} = 25 mA, f = 1513 MHz)	η_C	40	—	—	%
Load Mismatch Tolerance (V_{CC} = 26 Vdc, P_{OUT} = 12 W, I_{CQ} = 25 mA, f = 1513 MHz—all phase angles at frequency of test)	Ψ	—	—	5:1	—

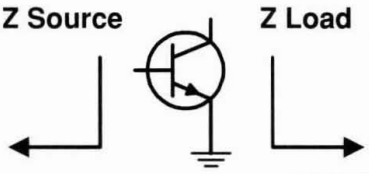
Typical Performance



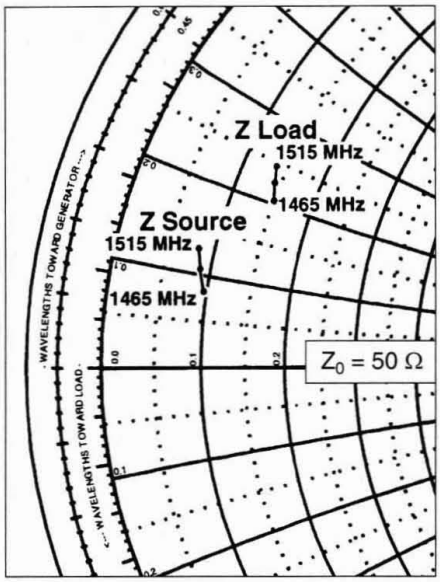


Impedance Data (shown for fixed-tuned broadband circuit)

V_{CC} = 26 Vdc, P_{OUT} = 12 W, I_{CQ} = 25 mA



Frequency	Z Source Ω		Z Load Ω	
MHz	R	jX	R	jX
1465	4.84	4.15	7.52	10.26
1490	4.45	5.33	7.16	11.29
1515	4.13	6.39	6.89	12.25



Typical Scattering Parameters

(V_{CE} = 26 V, I_C = 0.250 A)

f	S11		S21		S12		S22	
(MHz)	Mag	Ang	Mag	Ang	Mag	Ang	Mag	Ang
100	0.914	-179	6.76	103	0.018	34	0.597	172
200	0.920	180	5.58	99	0.019	40	0.591	173
300	0.930	177	3.28	85	0.025	51	0.581	176
400	0.930	175	2.46	77	0.031	56	0.581	177
500	0.924	174	2.02	69	0.037	58	0.578	179
600	0.916	172	1.75	62	0.044	59	0.580	180
700	0.909	171	1.56	56	0.051	59	0.580	179
800	0.901	170	1.43	49	0.057	58	0.570	180
900	0.895	168	1.35	42	0.064	57	0.566	-179
1000	0.882	167	1.30	35	0.070	56	0.561	-177
1100	0.867	165	1.28	28	0.076	54	0.564	-175
1200	0.844	164	1.28	19	0.082	51	0.569	-173
1300	0.818	163	1.30	9	0.086	48	0.584	-170
1400	0.785	163	1.32	-2	0.087	45	0.614	-167
1500	0.756	165	1.34	-16	0.084	42	0.672	-164
1600	0.744	168	1.33	-32	0.077	42	0.755	-164
1700	0.768	171	1.26	-51	0.071	48	0.852	-167
1800	0.823	173	1.13	-70	0.072	61	0.932	-171
1900	0.888	172	0.951	-88	0.086	72	0.980	-177
2000	0.941	169	0.766	-105	0.108	75	0.995	177
2100	0.974	166	0.601	-121	0.131	75	0.987	172
2200	0.992	162	0.467	-135	0.153	72	0.972	168

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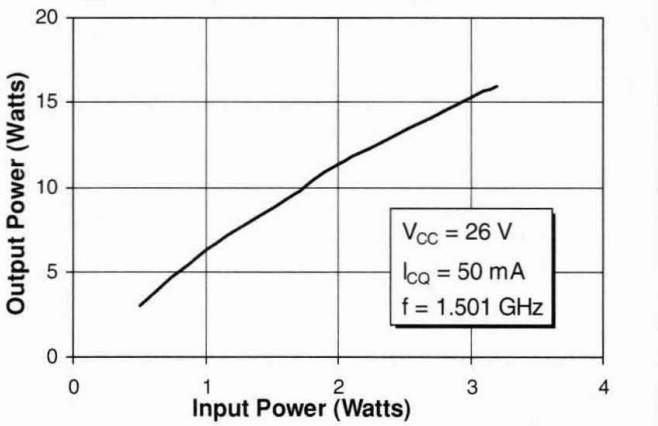
ERICSSON

PTB 20074
14 watts, 1.477–1.501 GHz
Cellular Radio RF Power Transistor

Description

The PTB 20074 is a class AB, NPN, common emitter RF power transistor intended for 26 Vdc operation from 1.477 to 1.501 GHz. Rated at 14 watts minimum output power, it may be used for both CW and PEP applications. Ion implantation, nitride surface passivation and gold metallization are used to ensure excellent device reliability. 100% lot traceability is standard.

- 14 watts, 1.477–1.501 GHz
- Class AB Characteristics
- 30% Collector Efficiency at 10 watts
- Gold Metallization
- Silicon Nitride Passivated



Package 20201

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CER}	50	Vdc
Collector-Base Voltage	V_{CBO}	50	Vdc
Emitter-Base Voltage (collector open)	V_{EBO}	4.0	Vdc
Collector Current (continuous)	I_C	1.4	Adc
Total Device Dissipation at T_{flange} = 25°C Above 25°C derate by	P_D	25 0.14	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{flange} = 70°C)	$R_{\theta JC}$	7.0	°C/W

Electrical Characteristics (100% Tested)

Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Breakdown Voltage C to E	I_B = 0 A, I_C = 40 mA, R_{BE} = 22 Ω	$V_{(BR)CER}$	50	—	—	Volts
Breakdown Voltage C to E	V_{BE} = 0 V, I_C = 40 mA	$V_{(BR)CES}$	50	—	—	Volts
Breakdown Voltage E to B	I_C = 0 A, I_E = 20 mA	$V_{(BR)EBO}$	4	5	—	Volts
DC Current Gain	V_{CE} = 10 V, I_C = 0.25 A	h_{FE}	20	50	120	—

RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{CC} = 26 Vdc, P_{OUT} = 10 W, I_{CQ} = 50 mA, f = 1.501 GHz)	G_{pe}	7	8	—	dB
Power Output at 1 dB Compression (V_{CC} = 26 Vdc, I_{CQ} = 50 mA, f = 1.501 GHz)	P-1dB	13	15	—	Watts
Collector Efficiency (V_{CC} = 26 Vdc, P_{OUT} = 10 W, I_{CQ} = 50 mA, f = 1.501 GHz)	η_C	30	—	—	%
Intermodulation Distortion (V_{CC} = 26 Vdc, P_{OUT} = 10 W(PEP), I_{CQ} = 50 mA, f_1 = 1.500 GHz, f_2 = 1.501 GHz)	IMD	—	-30	—	dBc
Load Mismatch Tolerance (V_{CC} = 26 Vdc, P_{OUT} = 10 W, I_{CQ} = 50 mA, f = 1.501 GHz—all phase angles at frequency of test)	Ψ	—	—	5:1	—

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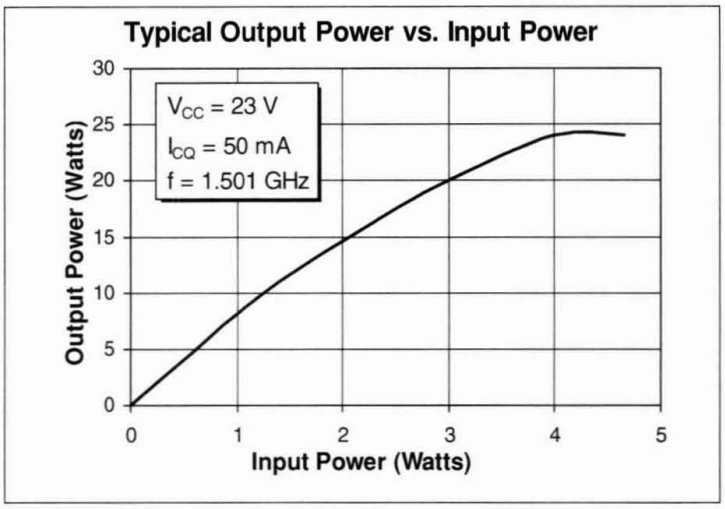
ERICSSON

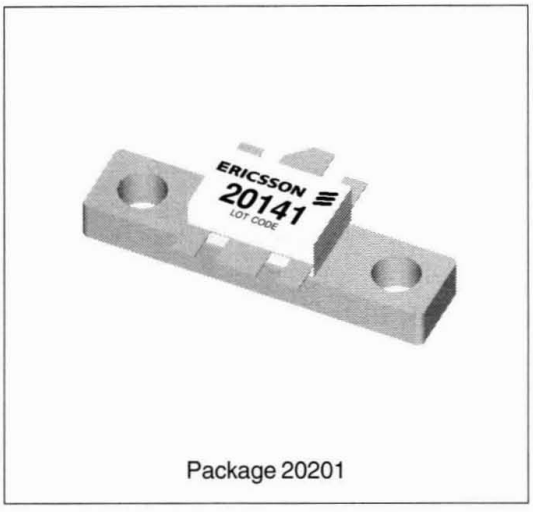
PTB 20141
18 Watts, 1.465–1.513 GHz
Cellular Radio RF Power Transistor

Description

The PTB 20141 is a class AB, NPN, common emitter RF power transistor intended for 23 Vdc operation from 1.465 to 1.513 GHz. Rated at 18 watts minimum output power, it may be used for both CW and PEP applications. Ion implantation, nitride surface passivation and gold metallization are used to ensure excellent device reliability. 100% lot traceability is standard.

- 18 Watts, 1.465–1.513 GHz
- Class AB Characteristics
- 45% Min Collector Efficiency at 9 Watts
- Gold Metallization
- Silicon Nitride Passivated





Package 20201

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CER}	50	Vdc
Collector-Base Voltage	V_{CBO}	50	Vdc
Emitter-Base Voltage (collector open)	V_{EBO}	4.0	Vdc
Collector Current (continuous)	I_C	2.0	Adc
Total Device Dissipation at T_{flange} = 25°C Above 25°C derate by	P_D	51.5 0.29	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{flange} = 70°C)	$R_{\theta JC}$	3.5	°C/W

PTB 20141

ERICSSON

Electrical Characteristics (100% Tested)

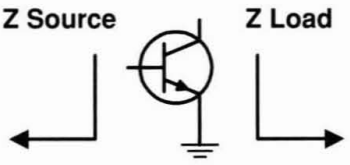
Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Breakdown Voltage C to E	I_B = 0 A, I_C = 40 mA, R_{BE} = 22 Ω	$V_{(BR)CER}$	50	—	—	Volts
Breakdown Voltage C to E	V_{BE} = 0 V, I_C = 40 mA	$V_{(BR)CES}$	50	—	—	Volts
Breakdown Voltage E to B	I_C = 0 A, I_E = 5 mA	$V_{(BR)EBO}$	4	5	—	Volts
DC Current Gain	V_{CE} = 5 V, I_C = 1 A	h_{FE}	20	40	120	—

RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{CC} = 23 Vdc, P_{OUT} = 9 W, I_{CQ} = 50 mA, f = 1.513 GHz)	G_{pe}	8.5	—	—	dB
Collector Efficiency (V_{CC} = 23 Vdc, P_{OUT} = 9 W, I_{CQ} = 50 mA, f = 1.513 GHz)	η_C	45	—	—	%
Intermodulation Distortion (V_{CC} = 23 Vdc, P_{OUT} = 9 W(PEP), I_{CQ} = 50 mA, f_1 = 1.500 GHz, f_2 = 1.501 GHz)	IMD	—	-29	—	dBc
Load Mismatch Tolerance (V_{CC} = 23 Vdc, P_{OUT} = 9 W, I_{CQ} = 50 mA, f = 1.513 GHz—all phase angles at frequency of test)	Ψ	—	—	5:1	—

Impedance Data (data shown for fixed-tuned broadband circuit)

(V_{CC} = 23 Vdc, P_{OUT} = 9 W, I_{CQ} = 50 mA)



Frequency	Z Source Ω		Z Load Ω	
GHz	R	jX	R	jX
1.465	3.9	-5.6	3.1	-0.56
1.489	3.4	-4.5	3.0	-0.39
1.513	2.9	-3.4	2.9	-0.20

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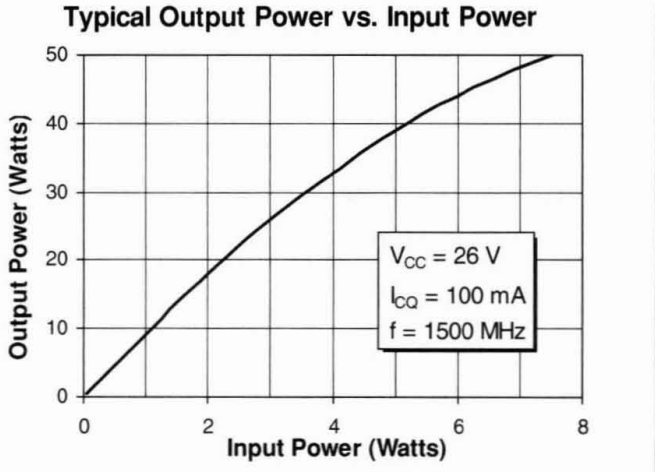
ERICSSON

PRE-RELEASE PTB 20124*
40 Watts, 1.465–1.513 GHz
Cellular Radio RF Power Transistor

Description

The PTB 20124 is an NPN common emitter RF power transistor intended for 26 Vdc class AB operation from 1.45 to 1.52 GHz. Rated at 40 watts minimum output power, it is specifically intended for cellular and DAB power applications. Ion implantation, nitride surface passivation and gold metallization ensure excellent device reliability. 100% lot traceability is standard.

- 40 Watts, 1.465–1.513 GHz
- Class AB Characteristics
- Gold Metallization
- Silicon Nitride Passivated



Package 20209

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CER}	55	Vdc
Collector-Base Voltage	V_{CBO}	55	Vdc
Emitter-Base Voltage (collector open)	V_{EBO}	4.0	Vdc
Collector Current (continuous)	I_C	7.8	Adc
Total Device Dissipation at T_{flange} = 25°C Above 25°C derate by	P_D	130 0.70	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{flange} = 70°C)	$R_{\theta JC}$	1.34	°C/W

* Note: Specifications for this product are preliminary and subject to change without notice. Please contact your sales representative for further product information. Complete product infromation is available on our Website at: www.ericsson.com/rfpower.

PTB 20124

ERICSSON

Electrical Characteristics (100% Tested)

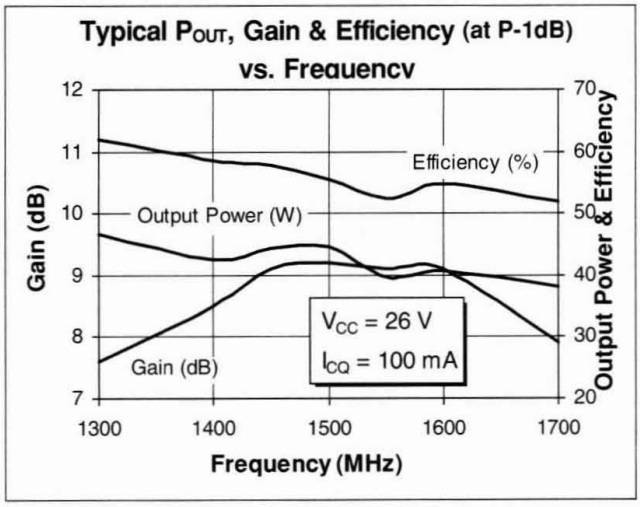
Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Breakdown Voltage C to E	I_C = 60 mA, R_{BE} = 27 Ω	$V_{(BR)CER}$	55	—	—	Volts
Breakdown Voltage C to E	V_{BE} = 0 V, I_C = 60 mA	$V_{(BR)CES}$	55	—	—	Volts
Breakdown Voltage E to B	I_C = 0 A, I_E = 5 mA	$V_{(BR)EBO}$	4	5	—	Volts
DC Current Gain	V_{CE} = 5 V, I_C = 300 mA	h_{FE}	20	50	120	—

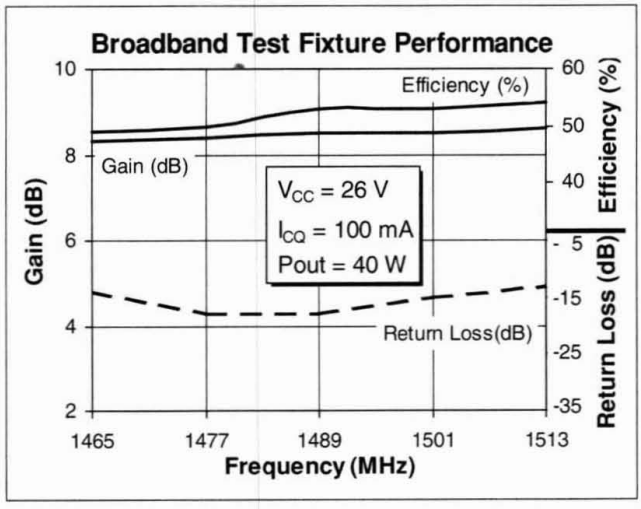
RF Specifications (100% Tested)

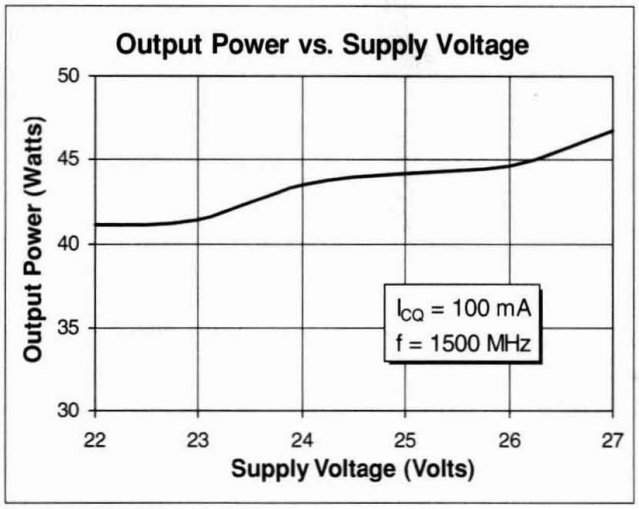
Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{CC} = 26 Vdc, P_{OUT} = 40 W, I_{CQ} = 100 mA, f = 1.5 GHz)	G_{pe}	7	8.5	—	dB
Collector Efficiency (V_{CC} = 26 Vdc, P_{OUT} = 40 W, I_{CQ} = 100 mA, f = 1.5 GHz)	η_C	—	50	—	%
Load Mismatch Tolerance (V_{CC} = 26 Vdc, P_{OUT} = 20 W, I_{CQ} = 100 mA, f = 1.5 GHz—all phase angles at frequency of test)	Ψ	—	—	5:1	—

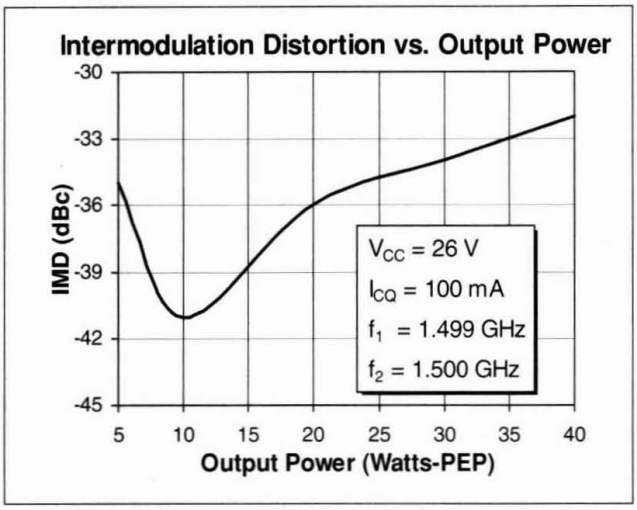
Typical Performance

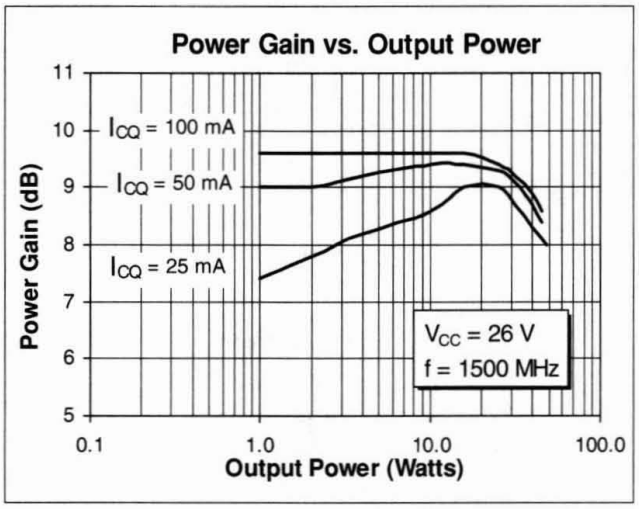
3





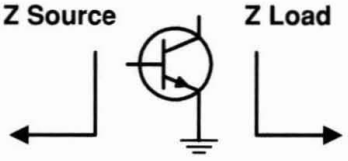




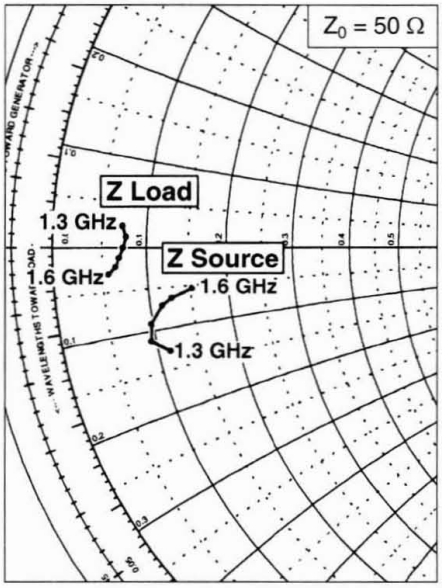


Impedance Data

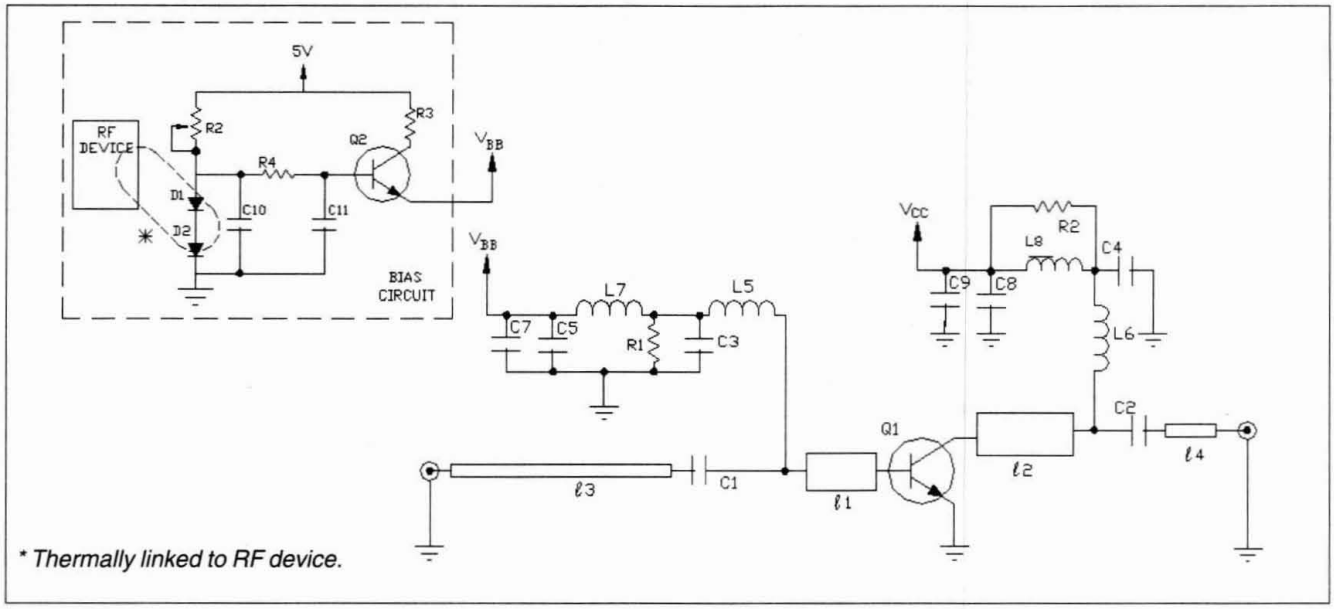
(V_{CC} = 26 Vdc, P_{OUT} = 40 W, I_{CQ} = 100 mA)



Frequency	Z Source Ω		Z Load Ω	
GHz	R	jX	R	jX
1.30	5.7	-6.4	3.6	1.2
1.40	4.7	-5.6	3.8	0.6
1.45	4.9	-4.6	3.7	0.0
1.50	5.7	-3.6	3.4	-0.6
1.55	6.3	-3.2	3.2	-1.1
1.60	7.6	-2.7	2.8	-1.5



Test Circuit



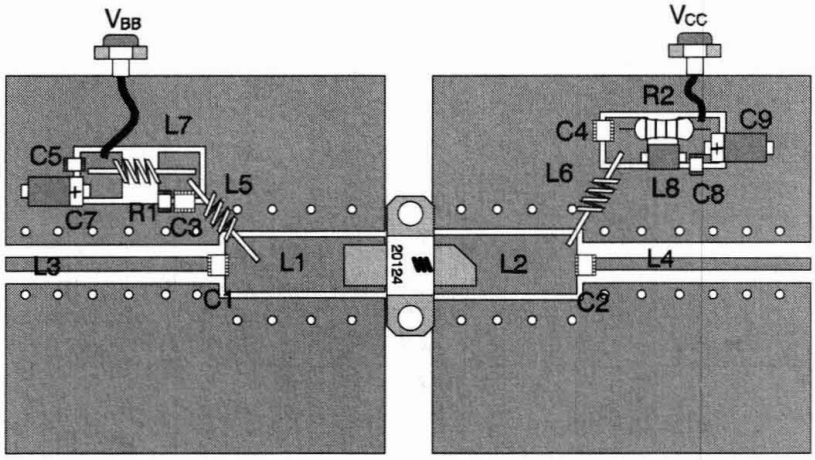
Schematic for f = 2 GHz

Q1	PTB 20124, NPN RF Transistor
L1	.185 λ 2GHz, Microstrip 18 Ω
L2	.195 λ 2GHz, Microstrip 9.5 Ω
L5, L6	4 T urn #20 AWG, .120" I.D.
L7	56 μA SMT Inductor
L8	Ferrite Bead
C1, C2	33 pF ATC-A
C3, C4	33 pF ATC-B
C5, C7	0.1 υF, 1206
C6, C8	10 pF SMT Electrolytic Capacitor

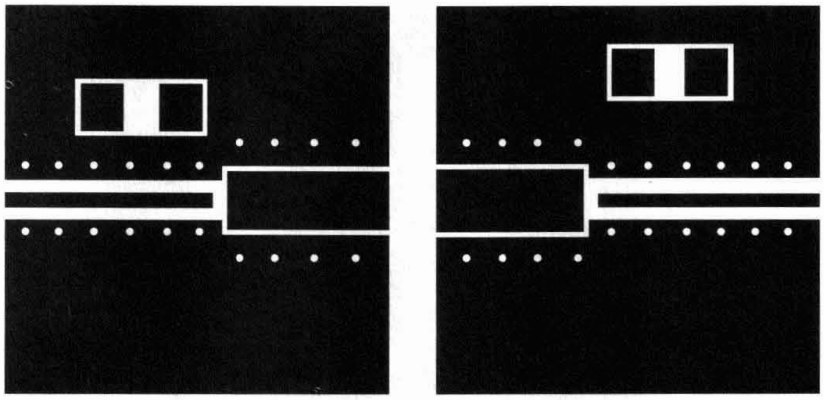
R1	22 Ω .5 W SMT Resistor
R2	12 Ω .5 W SMT Resistor
Circuit Board	.028" Dielectric Thickness, ε_r = 4.0, AlliedSignal, G200, 2 oz. copper

Bias Parts (not shown on assembly diagram)

Q2	BCP 56	SMT NPN Transistor
D1	BAV 99	Diode
C10, C11	0.1 pF	SMT Capacitor
R2	2K	Potentiometer
R3, R4	10 Ω	1206 SMT Resistor



Board Assembly (not to scale)



Artwork (1 inch ——— *)*

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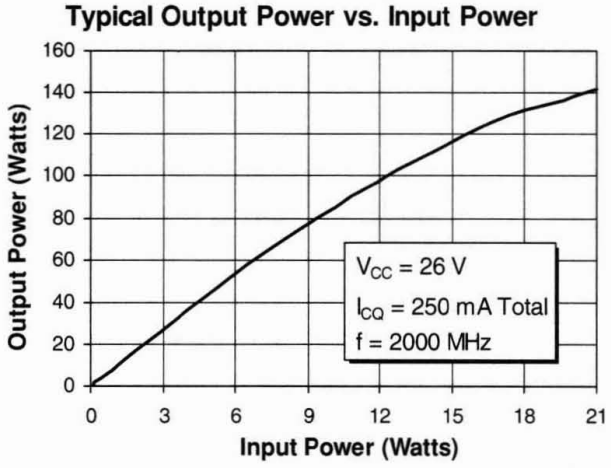
ERICSSON

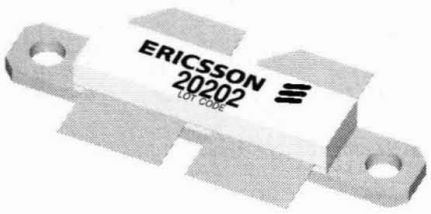
PTB 20202
125 Watts, 1465–1513 MHz
Cellular/DAB RF Power Transistor

Description

The PTB 20202 is an NPN common emitter RF power transistor intended for 26 Vdc class AB operation from 1.45 to 1.52 GHz. Rated at 125 watts minimum output power, it is specifically intended for cellular and DAB power applications. Ion implantation, nitride surface passivation and gold metallization ensure excellent device reliability. 100% lot traceability is standard.

- 125 Watts, 1465–1513 MHz
- Class AB Characteristics
- Gold Metallization
- Silicon Nitride Passivated





Package 20225

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CER}	50	Vdc
Collector-Base Voltage	V_{CBO}	50	Vdc
Emitter-Base Voltage (collector open)	V_{EBO}	4.0	Vdc
Collector Current (continuous) per side	I_C	14.5	Adc
Total Device Dissipation at T_{flange} = 25°C Above 25°C derate by	P_D	520 3.0	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{flange} = 70°C)	$R_{\theta JC}$	0.34	°C/W

This product not recommended or specified for CW or class A operation. Recommend two PTB 20173 for these applications.

Electrical Characteristics (100% Tested)

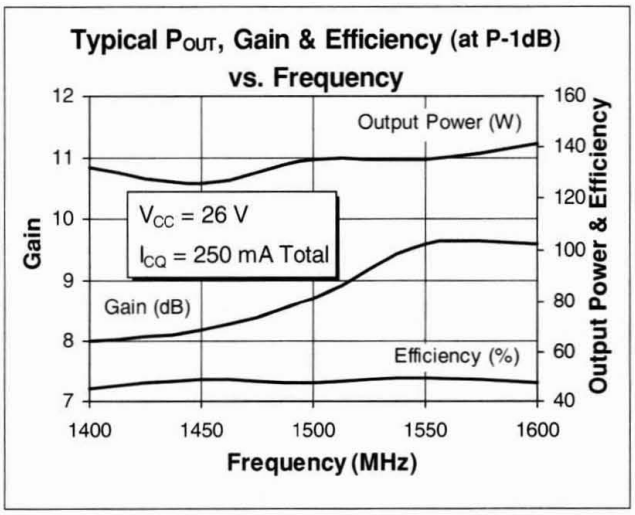
Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Breakdown Voltage C to E	V_{BE} = 0 V, I_C = 60 mA	$V_{(BR)CES}$	50	—	—	Volts
Breakdown Voltage C to E	I_C = 60 mA, R_{BE} = 27 Ω	$V_{(BR)CER}$	40	—	—	Volts
Breakdown Voltage E to B	I_C = 0 A, I_E = 25 mA	$V_{(BR)EBO}$	4.0	5.0	—	Volts
DC Current Gain	V_{CE} = 5 V, I_C = 300 mA	h_{FE}	20	50	120	—

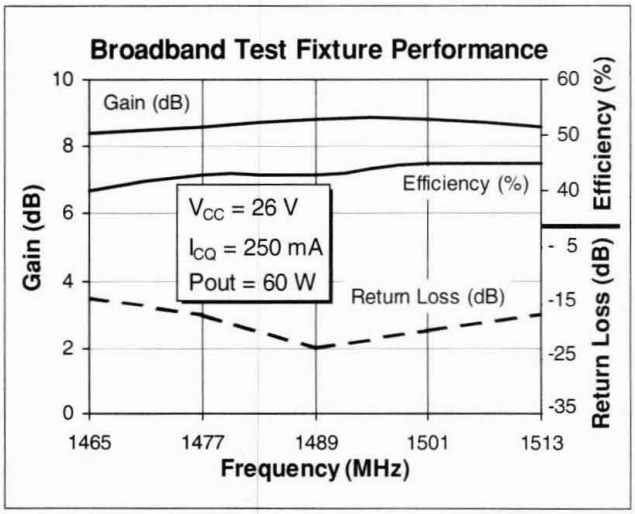
RF Specifications (100% Tested)

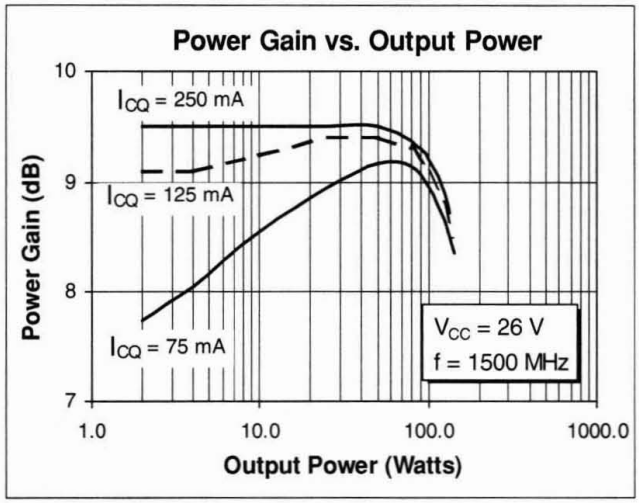
Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{CC} = 26 Vdc, P_{OUT} = 40 W, I_{CQ} = 250 mA total, f = 1.5 GHz)	G_{pe}	8.0	9.0	—	dB
Gain Compression (V_{CC} = 26 Vdc, I_{CQ} = 250 mA total, f = 1.5 GHz)	P-1dB	125	—	—	Watts
Intermodulation Distortion (V_{CC} = 26 Vdc, P_{OUT} = 125 $W_{(PEP)}$, I_{CQ} = 125 mA total, f_1 = 1.501 GHz, f_2 = 1.500 GHz)	IMD	—	-32	—	dBc
Load Mismatch Tolerance (V_{CC} = 26 Vdc, P_{OUT} = 62.5 W, I_{CQ} = 250 mA total, f = 1.5 GHz —all phase angles at frequency of test)	Ψ	—	—	5:1	—

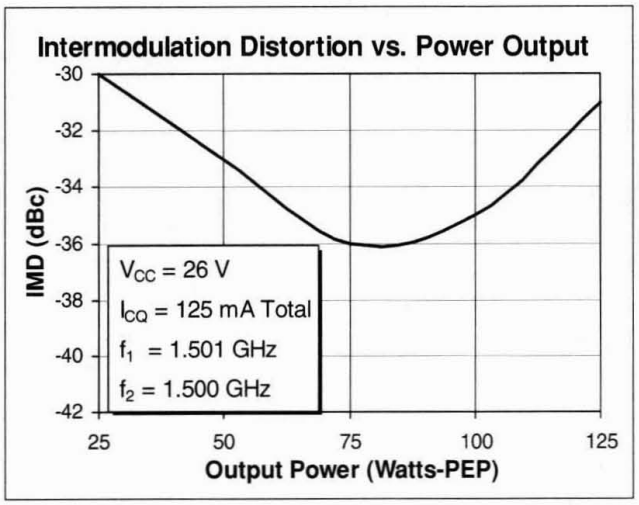
3

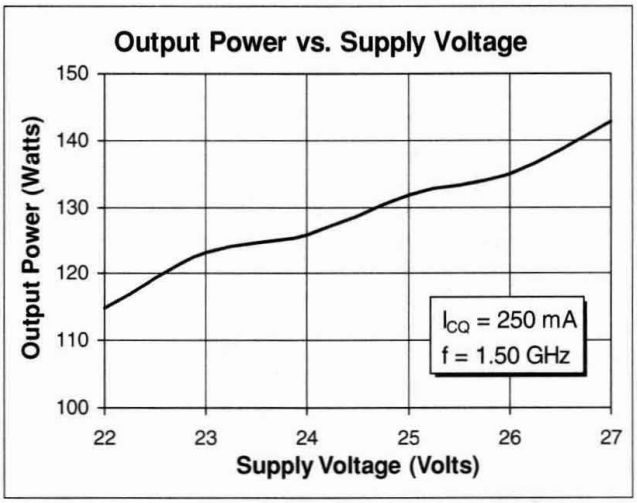
Typical Performance





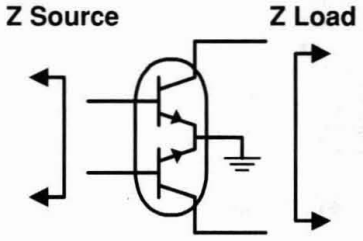




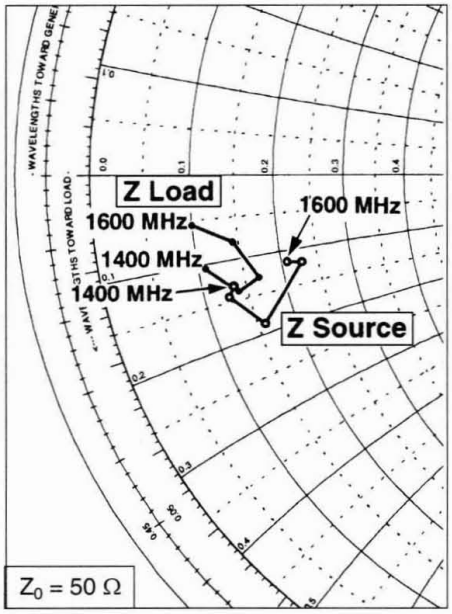


Impedance Data

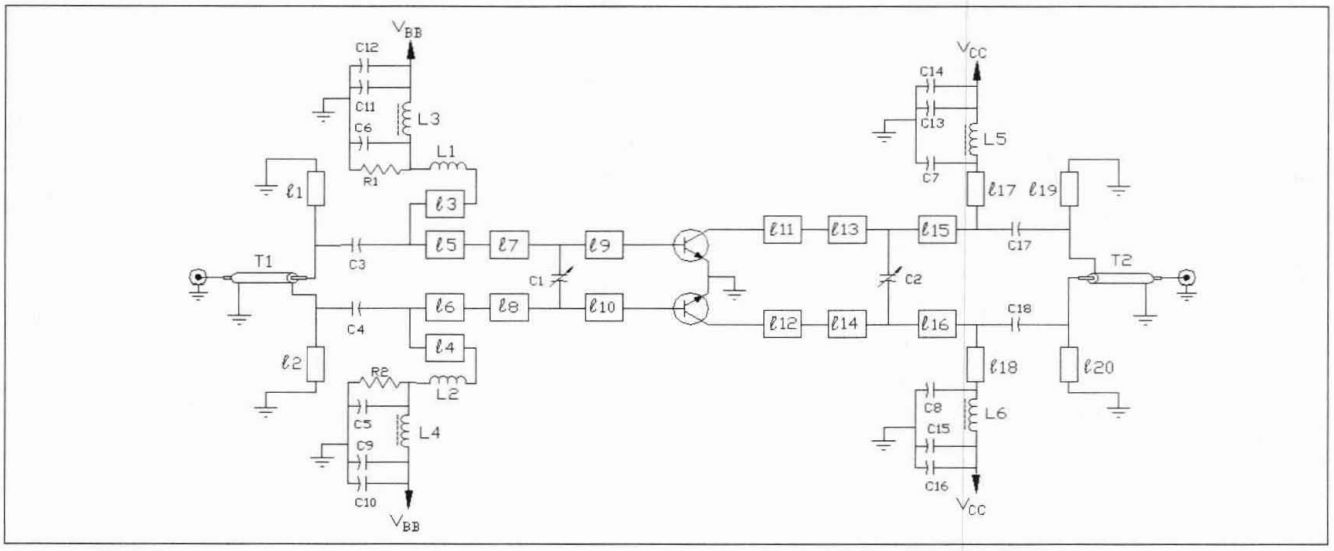
(V_{CC} = 26 Vdc, P_{OUT} = 40 W, I_{CQ} = 250 mA total)



Frequency	Z Source Ω		Z Load Ω	
MHz	R	jX	R	jX
1.40	6.8	-6.6	5.4	-5.3
1.45	6.4	-7.2	7.0	-7.0
1.50	8.0	-9.4	8.4	-6.4
1.55	11.4	-6.0	7.2	-4.0
1.60	10.4	-5.8	5.0	-2.8

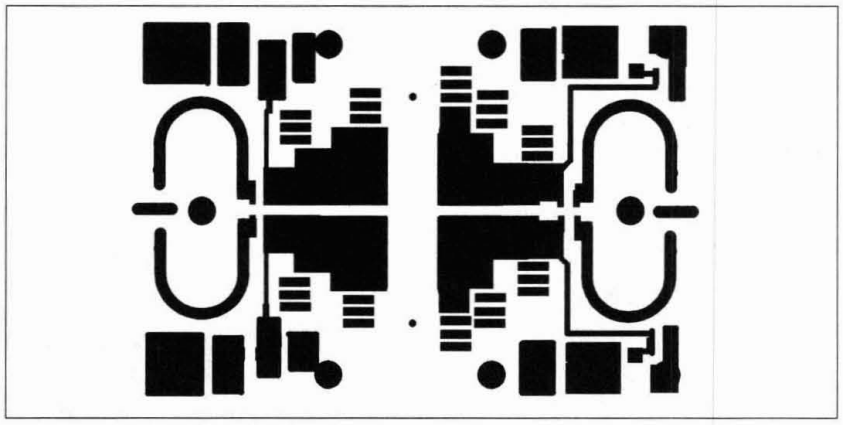


Test Circuit



Block Diagram for f = 1.5 GHz

Q1	PTB 20202 NPN RF Transistor	L1, L2	6.8 nH SMT Inductor
ℓ1, ℓ2, ℓ19, ℓ20	.25λ 1.5 GHz Microstrip 50 Ω	L3, L4	56 nH SMT Inductor
ℓ3, ℓ4	.0850λ 1.5 GHz Microstrip 80 Ω	L5, L6	4 mm. SMT Ferrite
ℓ5, ℓ6	.0352λ 1.5 GHz Microstrip 22 Ω	C1, C2	0 - 4 pF Johanson Piston Trimmer
ℓ7, ℓ8	.0395λ 1.5 GHz Microstrip 16 Ω	C3-8, C17, C18	33 pF (B ATC 100)
ℓ9, ℓ10	.0707λ 1.5 GHz Microstrip 13 Ω	C9, C11, C13, C15	.1 μF 1206
ℓ11, ℓ12	.0437λ 1.5 GHz Microstrip 9.91 Ω	C10, C12, C14, C16	10 μF SMT Tantalum
ℓ13, ℓ14	.0303λ 1.5 GHz Microstrip 13 Ω	R1, R2	22 Ω SMT
ℓ15, ℓ16	.0748λ 1.5 GHz Microstrip 20 Ω	T1, T2	UT 70-50
ℓ17, ℓ18	.2520λ 1.5 GHz Microstrip 75 Ω	Circuit Board	.031" Dielectric Thickness, ε_r = 4.0, AlliedSignal, G200, 2 oz. copper



Artwork (1 inch ——— *)*

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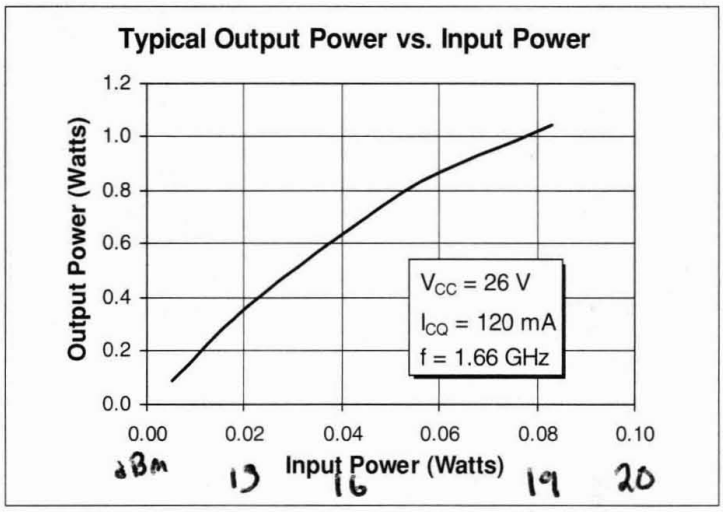
ERICSSON

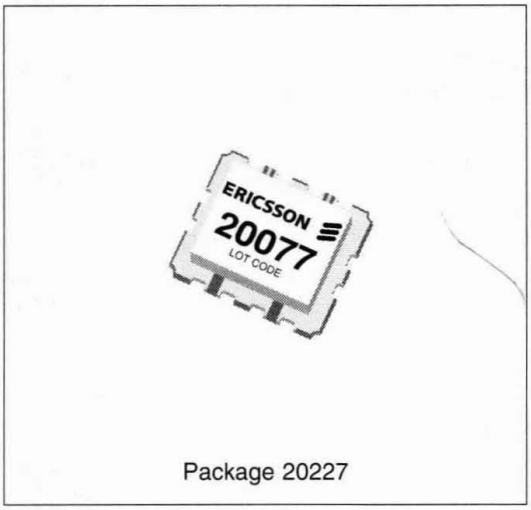
PTB 20077
0.7 Watts, 1525–1660 MHz
INMARSAT RF Power Transistor

Description

The PTB 20077 is a class A, NPN, common emitter RF power transistor intended for 26 Vdc operation from 1525 to 1660 MHz. Rated at 0.7 watt minimum output power, it may be used for both CW and PEP applications. Ion implantation, nitride surface passivation and gold metallization ensure excellent device reliability. 100% lot traceability is standard.

- 0.7 Watt, 1525–1660 MHz
- Class A Characteristics
- Gold Metallization
- Silicon Nitride Passivated
- Surface Mountable
- Available in Tape and Reel





Package 20227

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CER}	60	Vdc
Collector-Base Voltage	V_{CBO}	60	Vdc
Emitter-Base Voltage (collector open)	V_{EBO}	4.0	Vdc
Collector Current (continuous)	I_C	0.5	Adc
Total Device Dissipation at T_{flange} = 25°C Above 25°C derate by	P_D	5.4 0.031	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{flange} = 70°C)	$R_{\theta JC}$	32.3	°C/W

Electrical Characteristics (100% Tested)

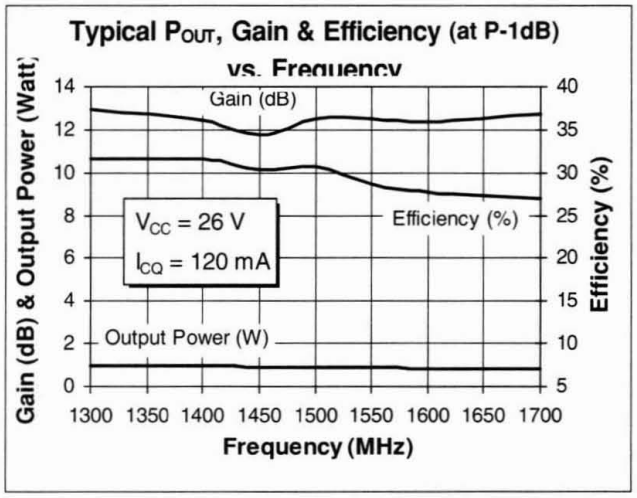
Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Breakdown Voltage C to E	V_{BE} = 0 V, I_C = 5 mA	$V_{(BR)CES}$	60	—	—	Volts
Breakdown Voltage C to E	I_B = 0 A, I_C = 10 mA, R_{BE} = 22 Ω	$V_{(BR)CER}$	60	—	—	Volts
Breakdown Voltage E to B	I_C = 0 A, I_E = 5 mA	$V_{(BR)EBO}$	4.0	5	—	Volts
DC Current Gain	V_{CE} = 5 V, I_C = 250 mA	h_{FE}	20	40	—	—

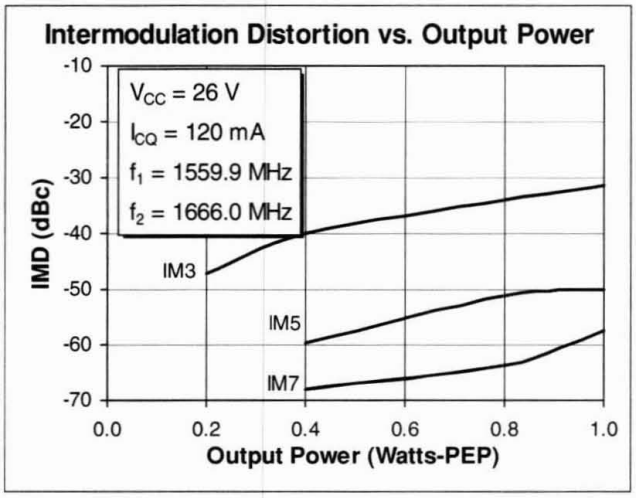
RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{CC} = 25 Vdc, POUT = 0.2 W, I_{CQ} = 120 mA, f = 1.525; 1.66 GHz)	G_{pe}	10	12	—	dB
Power Output at 1 dB Compression (V_{CC} = 25 Vdc, I_{CQ} = 120 mA, f = 1.525; 1.66 GHz)	P-1dB	0.7	0.9	—	Watts
Load Mismatch Tolerance (V_{CC} = 25 Vdc, POUT = 0.7 W, I_{CQ} = 120 mA, f = 1.66 GHz—all phase angles at frequency of test)	Ψ	—	—	5:1	—

3

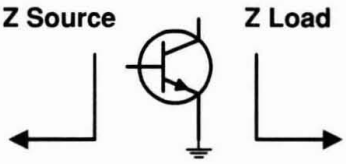
Typical Performance



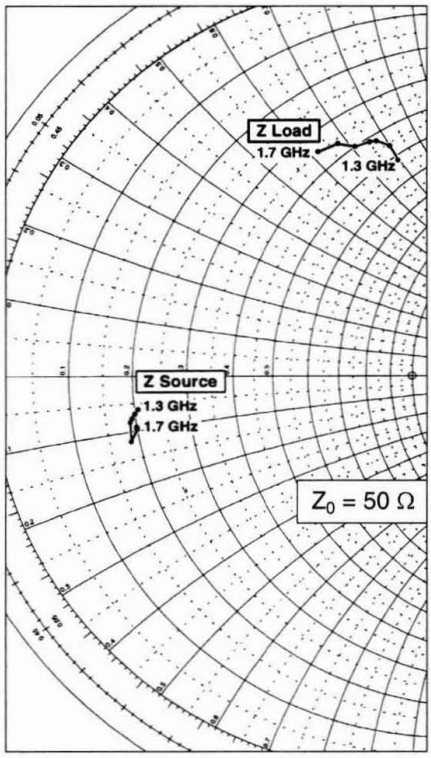


Impedance Data

V_{CC} = 25 Vdc, P_{OUT} = 0.7 W, I_{CQ} = 120 mA



Frequency	Z Source Ω		Z Load Ω	
GHz	R	jX	R	jX
1.30	10.3	-3.1	25.9	39.8
1.40	10.0	-3.5	22.9	40.0
1.45	9.7	-3.9	21.1	38.6
1.50	9.5	-4.2	20.7	37.7
1.55	9.3	-5.9	20.0	35.5
1.60	10.0	-4.9	18.2	33.8
1.70	10.0	-4.7	17.4	31.0



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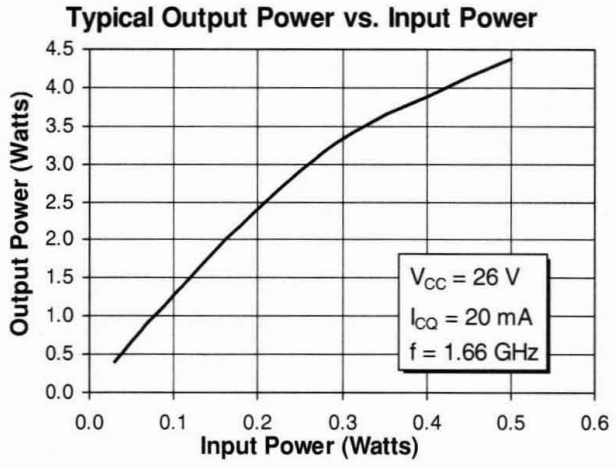
ERICSSON

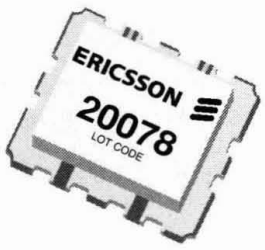
PTB 20078
2.5 Watts, 1525–1660 MHz
INMARSAT RF Power Transistor

Description

The PTB 20078 is a class AB, NPN, common emitter RF power transistor intended for 26 Vdc operation from 1525 to 1660 MHz. Rated at 2.5 watts minimum output power, it may be used for both CW and PEP applications. Ion implantation, nitride surface passivation and gold metallization are used to ensure excellent device reliability. 100% lot traceability is standard.

- 2.5 Watts, 1525–1660 MHz
- Class AB Characteristics
- Gold Metallization
- Silicon Nitride Passivated
- Surface Mountable
- Available in Tape and Reel





Package 20227

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CER}	50	Vdc
Collector-Base Voltage	V_{CBO}	50	Vdc
Emitter-Base Voltage (collector open)	V_{EBO}	4.0	Vdc
Collector Current (continuous)	I_C	0.5	Adc
Total Device Dissipation at T_{flange} = 25°C Above 25°C derate by	P_D	10.0 0.057	Watts W/°C
Storage Temperature	T_{stg}	150	°C
Thermal Resistance (T_{flange} = 70°C)	$R_{\theta JC}$	17.5	°C/W

PTB 20078

ERICSSON

Electrical Characteristics (100% Tested)

Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Breakdown Voltage C to E	V_{BE} = 0 V, I_C = 5 mA	$V_{(BR)CES}$	50	—	—	Volts
Breakdown Voltage C to E	I_B = 0 A, I_C = 10 mA, R_{BE} = 22 Ω	$V_{(BR)CER}$	50	—	—	Volts
Breakdown Voltage E to B	I_C = 0 A, I_E = 5 mA	$V_{(BR)EBO}$	4	5	—	Volts
DC Current Gain	V_{CE} = 5 V, I_C = 250 mA	h_{FE}	20	40	—	—

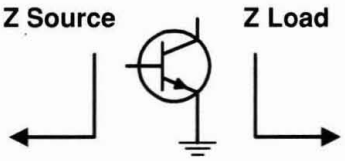
RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{CC} = 26 Vdc, P_{OUT} = 1.0 W, I_{CQ} = 20 mA, f = 1.525; 1.66 GHz)	G_{pe}	9	11.0	—	dB
Power Out at 1 dB Compression (V_{CC} = 26 Vdc, I_{CQ} = 20 mA, f = 1.525; 1.66 GHz)	P-1dB	2.5	3.5	—	Watts
Load Mismatch Tolerance (V_{CC} = 26 Vdc, P_{OUT} = 2.5 W, I_{CQ} = 20 mA f = 1.660 GHz—all phase angles at frequency of test)	Ψ	—	—	5:1	—

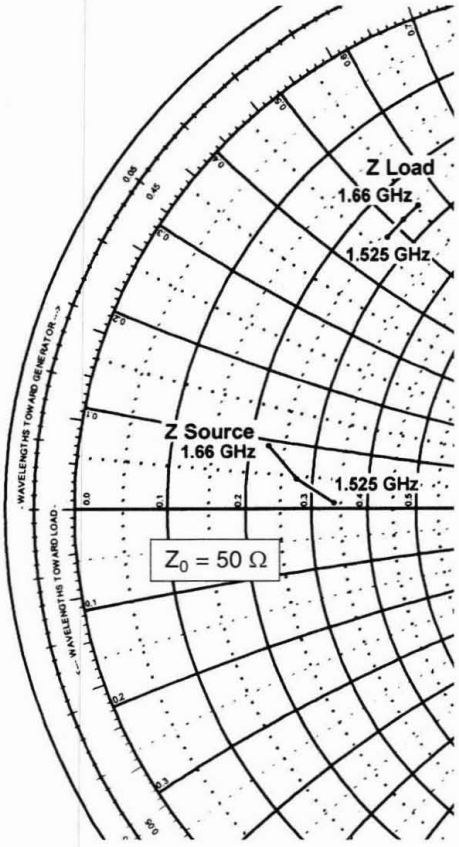
3

Impedance Data (data shown for fixed-tuned broadband circuit)

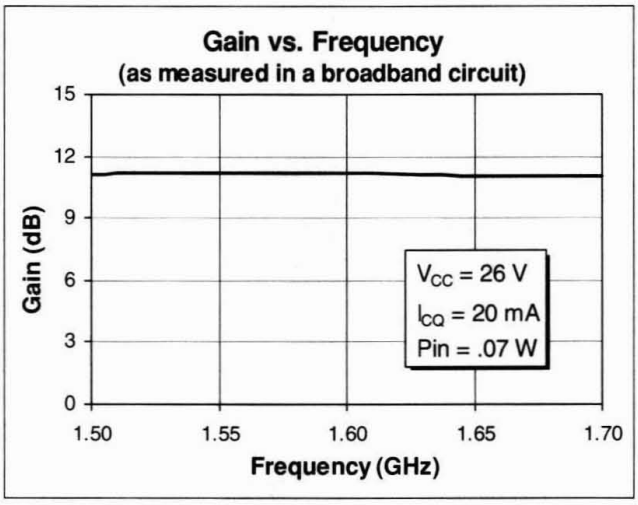
(V_{CC} = 26 Vdc, P_{OUT} = 2.5 W, I_{CQ} = 20 mA)



Frequency	Z Source Ω		Z Load Ω	
GHz	R	jX	R	jX
1.525	16.9	0.5	12.9	23.8
1.593	13.7	2.3	12.9	25.9
1.660	11.3	4.6	12.9	27.7



Typical Performance



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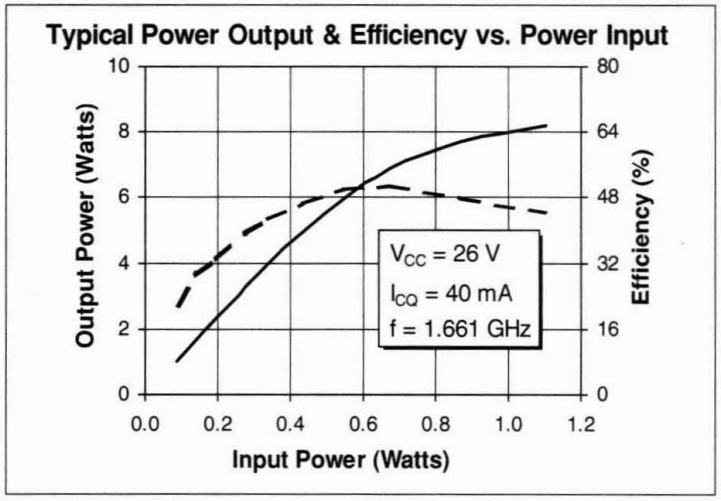
ERICSSON

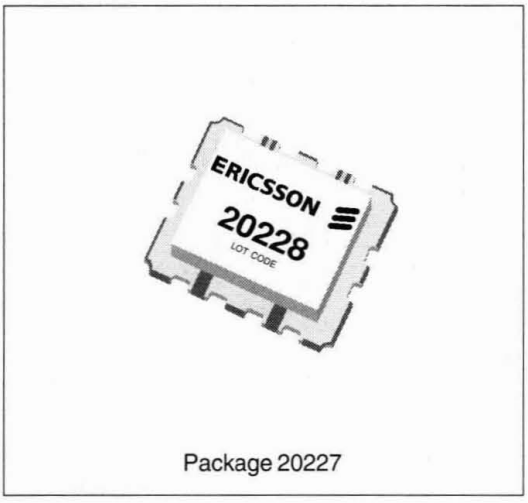
PTB 20228
6.5 Watts, 1.62–1.66 GHz
RF Power Transistor

Description

The PTB 20228 is a class AB, NPN, common emitter RF power transistor intended for 26 Vdc operation from 1.626 to 1.661 GHz. Rated at 6 watts minimum output power, it may be used for both CW and PEP applications. Ion implantation, nitride surface passivation and gold metallization are used to ensure excellent device reliability. 100% lot traceability is standard.

- 6.5 Watts, 1.62–1.66 GHz
- Class AB Characteristics
- 40% Collector Efficiency at 6.5 Watts
- Surface Mountable
- Available in Tape and Reel
- Gold Metallization
- Silicon Nitride Passivated





Package 20227

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CER}	50	Vdc
Collector-Base Voltage	V_{CBO}	50	Vdc
Emitter-Base Voltage (collector open)	V_{EBO}	4.0	Vdc
Collector Current (continuous)	I_C	1.0	Adc
Total Device Dissipation at T_{flange} = 25°C Above 25°C derate by	P_D	19.7 0.112	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{flange} = 70°C)	$R_{\theta JC}$	8.9	°C/W

PTB 20228

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Electrical Characteristics (100% Tested)

Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Breakdown Voltage C to E	I_B = 0 A, I_C = 5 mA	$V_{(BR)CEO}$	20	—	—	Volts
Breakdown Voltage C to E	V_{BE} = 0 V, I_C = 5 mA	$V_{(BR)CES}$	50	—	—	Volts
Breakdown Voltage C to E	I_B = 0 A, I_C = 5 mA, R_{BE} = 22 Ω	$V_{(BR)CER}$	50	—	—	Volts
Breakdown Voltage E to B	I_C = 0 A, I_E =5 mA	$V_{(BR)EBO}$	4	5	—	Volts
DC Current Gain	V_{CE} = 5 V, I_C = 250 mA	h_{FE}	20	40	—	—
Output Capacitance	V_{CB} = 26 V, I_e = 0, f = 1 MHz	Cob		6.1		pF

RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{CC} = 26 Vdc, P_{OUT} = 4 W, I_{CQ} = 40 mA, f = 1.626 & 1.661 GHz)	G_{pe}	8.5	9.5	—	dB
Gain Compression (V_{CC} = 26 Vdc, I_{CQ} = 40 mA, f = 1.661 GHz)	P-1dB	6.5	—	—	Watts
Collector Efficiency (V_{CC} = 26 Vdc, P_{OUT} = 6.5 W, I_{CQ} = 40 mA, f = 1.626 & 1.661 GHz)	η_C	40	—	—	%
Load Mismatch Tolerance (V_{CC} = 26 Vdc, P_{OUT} = 6.5 W, I_{CQ} = 40 mA, f = 1.661 GHz—all phase angles at frequency of test)	Ψ	—	—	5:1	—

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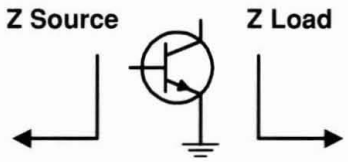
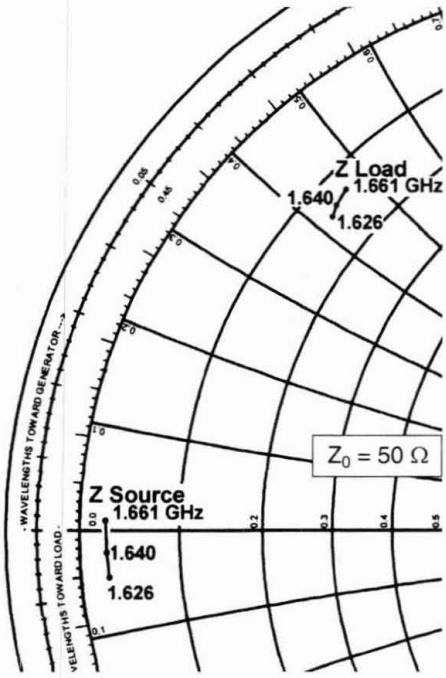
Impedance Data (data shown for fixed-tuned broadband circuit)

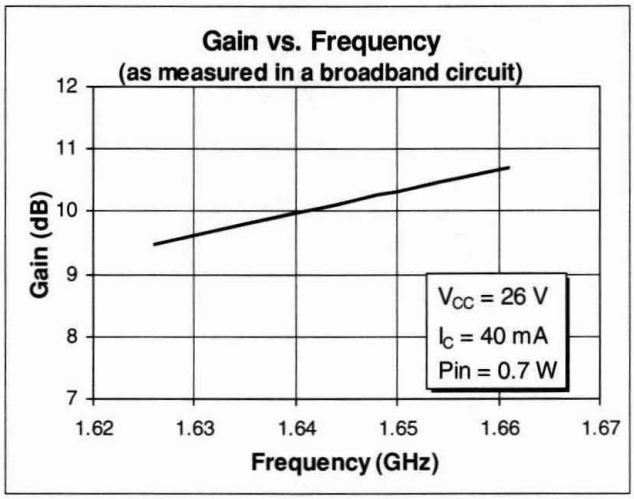
(V_{CC} = 26 Vdc, P_{OUT} = 6.5 W, I_{CQ} = 40 mA)



Frequency	Z Source Ω		Z Load Ω	
GHz	R	jX	R	jX
1.626	1.32	-2.29	7.02	21.19
1.640	1.27	-1.12	6.72	21.98
1.661	1.21	0.47	6.46	23.17



Typical Performance



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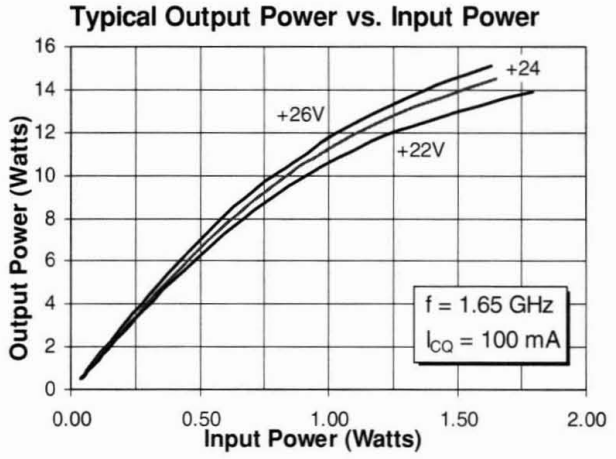
ERICSSON

PTB 20079
10 Watts, 1.6–1.7 GHz
INMARSAT RF Power Transistor

Description

The PTB 20079 is a class A/AB, NPN, silicon bipolar junction, internally-matched, common emitter RF Power transistor intended for 26 Vdc operation across 1.6 to 1.7 GHz frequency band. It is rated at 10 Watts minimum output power for PEP applications. Ion implantation, nitride surface passivation and gold metallization ensure excellent device reliability. 100% lot traceability is standard.

- 10 Watts, 1.6–1.7 GHz
- Class A/AB Characteristics
- 38% Collector Efficiency at 10 Watts
- Gold Metallization
- Silicon Nitride Passivated



Package 20209

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CER}	50	Vdc
Collector-Base Voltage	V_{CBO}	50	Vdc
Emitter-Base Voltage (collector open)	V_{EBO}	4.0	Vdc
Collector Current (continuous)	I_C	1.4	Adc
Total Device Dissipation at T_{flange} = 25° C Above 25° C derate by	P_D	52 0.29	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{flange} = 70° C)	$R_{\theta JC}$	3.4	°C/W

PTB 20079

ERICSSON

Electrical Characteristics (100% Tested)

Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Breakdown Voltage C to E	I_C = 15 mA, R_{BE} = 22 Ω	$V_{(BR)CER}$	55	—	—	Vdc
Breakdown Voltage E to B	I_E = 10 mA	$V_{(BR)EBO}$	4.0	—	—	Vdc
DC Current Gain	I_C = 1 A, V_{CE} = 5 V	h_{FE}	20	—	100	—

RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Power Gain, Common-Emitter (V_{CC} = 26 Vdc, P_{OUT} = 3 W, I_{CQ} = 120 mA, f = 1.65 GHz)	G_{pe}	10.5	11	—	dB
Efficiency (V_{CC} = 26 Vdc, P_{OUT} = 10 W, I_{CQ} = 120 mA, f = 1.65 GHz)	η_C	37	40	—	%
Power Output at 1 dB Compression (V_{CC} = 26 Vdc, I_{CQ} = 120 mA, f = 1.65 GHz)	P-1dB	10.0	12	—	Watts

Impedance Data (data shown for fixed-tuned broadband circuit)

V_{CC} = 26 Vdc, P_{OUT} = 10 W, I_{CQ} = 120 mA

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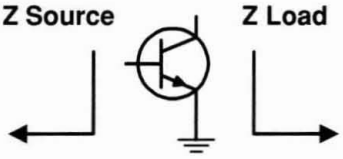
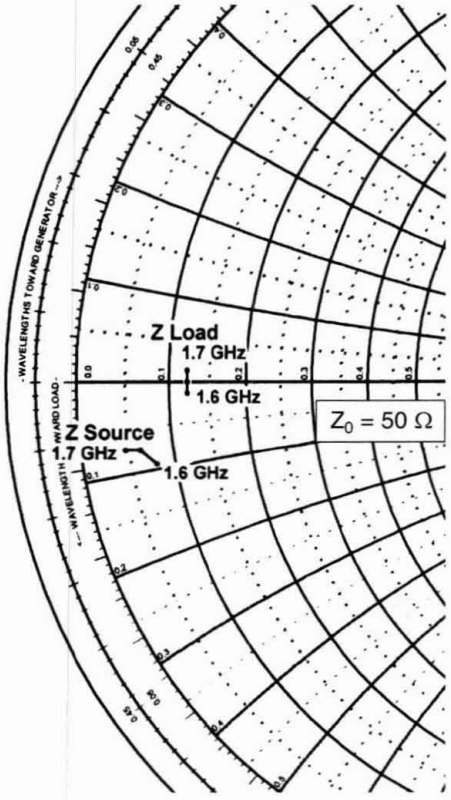
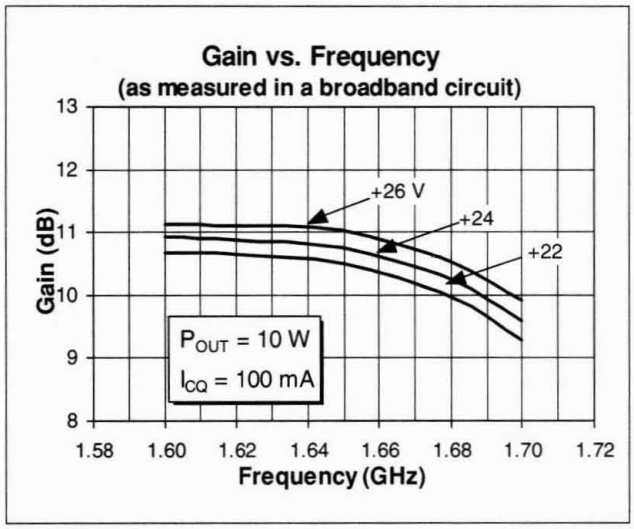
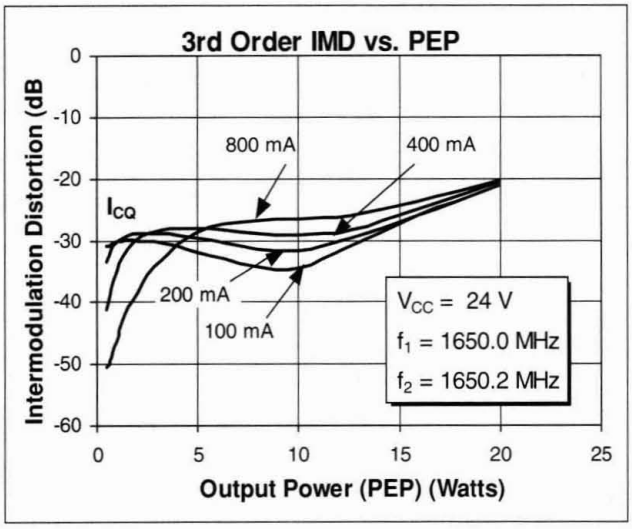


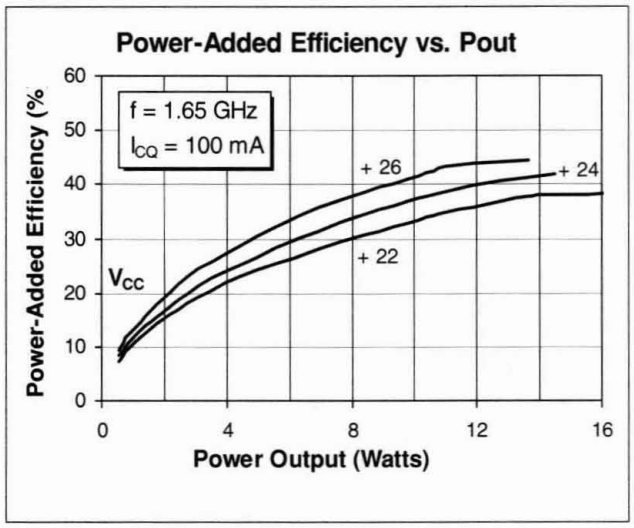
Frequency	Z Source Ω		Z Load Ω	
GHz	R	jX	R	jX
1.6	3.9	-4.7	6.1	-0.7
1.65	3.1	-3.8	6.1	0.0
1.7	2.3	-3.7	6.1	0.7



Typical Performance







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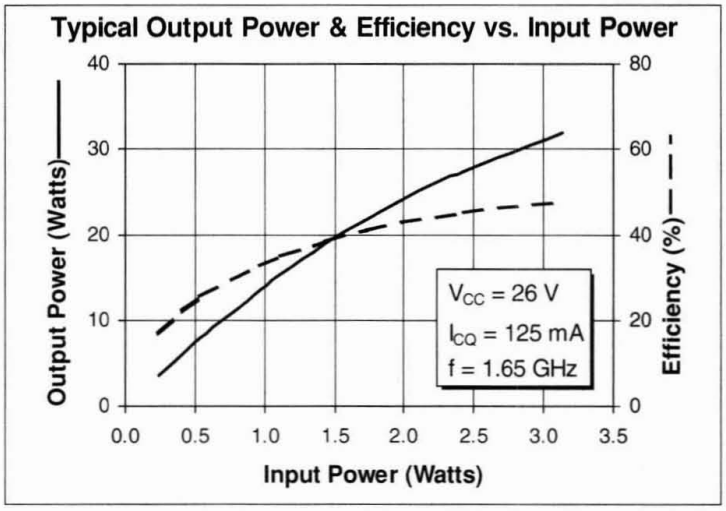
ERICSSON

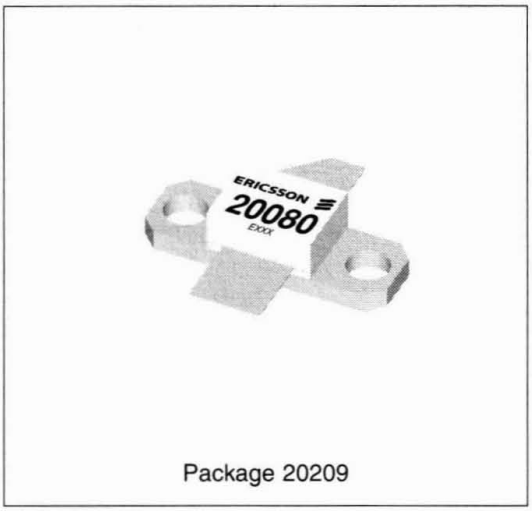
PTB 20080
25 Watts, 1.6–1.7 GHz
RF Power Transistor

Description

The PTB 20080 is a class A/AB, NPN, silicon bipolar junction, internally-matched RF power transistor intended for 26 Vdc operation from 1.6 to 1.7 GHz. It is rated at 25 Watts minimum output power for PEP applications. Ion implantation, nitride surface passivation and gold metallization ensure excellent device reliability. 100% lot traceability is standard.

- 25 Watts, 1.6–1.7 GHz
- Class AB Characteristics
- 40% Collector Efficiency at 25 Watts
- Gold Metallization
- Silicon Nitride Passivated





Package 20209

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CER}	50	Vdc
Collector-Base Voltage	V_{CBO}	50	Vdc
Emitter-Base Voltage (collector open)	V_{EBO}	4.0	Vdc
Collector Current (continuous)	I_C	3.4	Adc
Total Device Dissipation at T_{flange} = 25° C Above 25° C derate by	P_D	123 0.7	Watts W/°C
Storage Temperature Range	T_{STG}	150	°C
Thermal Resistance (T_{flange} = 70°C)	$R_{\theta JC}$	1.43	°C/W

PTB 20080

ERICSSON

Electrical Characteristics (100% Tested)

Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Breakdown Voltage C to B	V_{BE} = 0 V, I_C = 15 mA	$V_{(BR)CES}$	50	—	—	Vdc
Breakdown Voltage E to B	I_C = 5 mA	$V_{(BR)EBO}$	4.0	—	—	Vdc
Cut-off Current C to E	V_{CE} = 26 V	I_{CES}	—	—	10	mA
DC Current Gain	V_{CE} = 5 V, I_C = 2 A	h_{FE}	30	—	—	—

RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Power Gain (V_{CC} = 26 Vdc, P_{OUT} = 10 W, I_{CQ} = 125 mA, f = 1.65 GHz)	G_{pe}	10.5	11.5	—	dB
Power Output at 1 dB Compression (V_{CC} = 26 Vdc, I_{CQ} = 125 mA, f = 1.65 GHz)	P-1dB	25	—	—	Watts
Collector Efficiency (V_{CC} = 26 Vdc, P_{OUT} = 25 W, I_{CQ} = 125 mA, f = 1.65 GHz)	η_C	40	44	—	%
Load Mismatch Tolerance (V_{CC} = 26 Vdc, P_{OUT} = 25 W, I_{CQ} = 125 mA, f = 1.65 GHz—all phase angles at frequency of test)	Ψ	—	—	10:1	—

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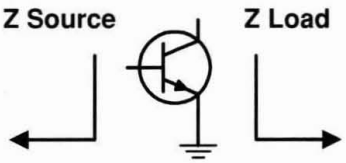
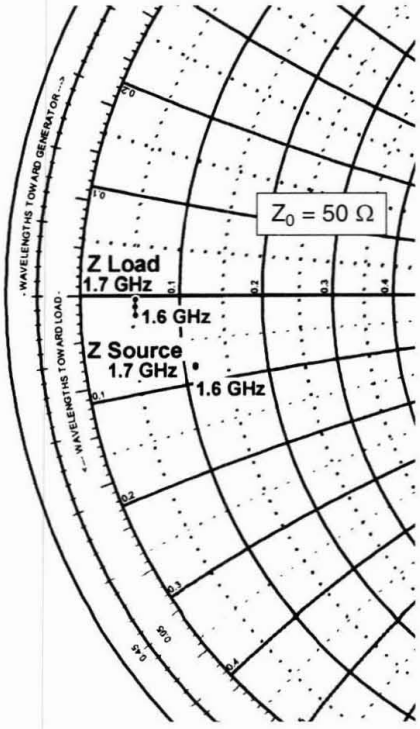
Impedance Data (data shown for fixed-tuned broadband circuit)

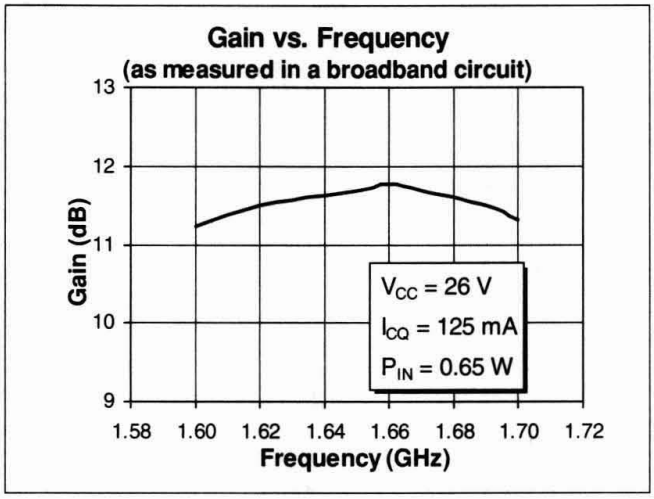
V_{CC} = 26 Vdc, P_{OUT} = 25 W, I_{CQ} = 125 mA



Frequency	Z Source Ω		Z Load Ω	
GHz	R	jX	R	jX
1.60	5.6	-4.1	2.6	-1.0
1.65	5.6	-4.0	2.6	-0.6
1.70	5.6	-4.0	2.7	-0.2



Typical Performance



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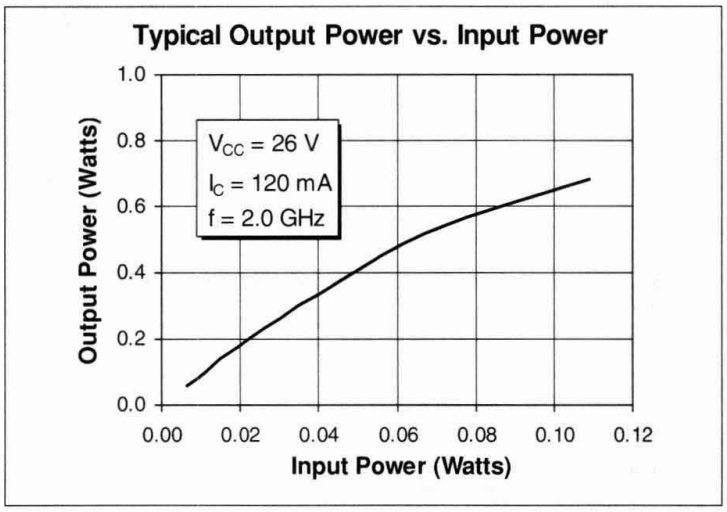
ERICSSON

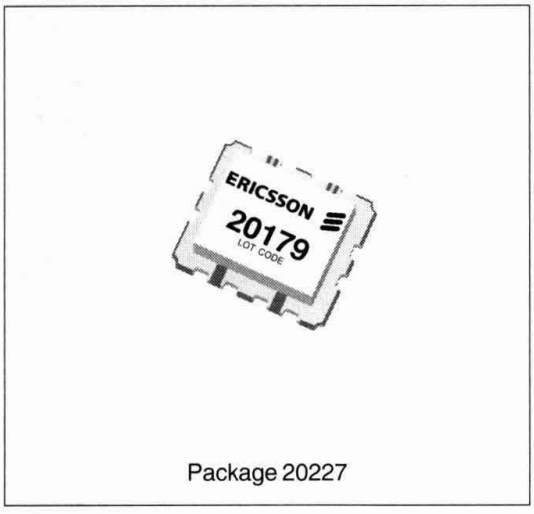
PTB 20179
0.4 Watt, 1.8–2.0 GHz
Cellular Radio RF Power Transistor

Description

The PTB 20179 is an NPN, common emitter RF power transistor intended for class A, 26 Vdc operation from 1.8 to 2.0 GHz. Rated at 0.4 watt minimum output power, it may be used for both CW and PEP applications. Ion implantation, nitride surface passivation and gold metallization are used to ensure excellent device reliability. 100% lot traceability is standard.

- 0.4 Watt, 1.8–2.0 GHz
- Class A Characteristics
- Gold Metallization
- Silicon Nitride Passivated
- Surface Mountable
- Available in Tape and Reel





Package 20227

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CER}	50	Vdc
Collector-Base Voltage	V_{CBO}	50	Vdc
Emitter-Base Voltage (collector open)	V_{EBO}	4.0	Vdc
Collector Current (continuous)	I_C	0.5	Adc
Total Device Dissipation at T_{flange} = 25°C Above 25°C derate by	P_D	5.4 0.031	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{flange} = 70°C)	$R_{\theta JC}$	32.3	°C/W

Electrical Characteristics (100% Tested)

Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Breakdown Voltage C to E	I_B = 0 A, I_C = 10 mA, R_{BE} = 22 Ω	$V_{(BR)CER}$	50	—	—	Volts
Breakdown Voltage C to E	V_{BE} = 0 V, I_C = 5 mA	$V_{(BR)CES}$	50	—	—	Volts
Breakdown Voltage E to B	I_C = 0 A, I_E = 5 mA	$V_{(BR)EBO}$	4	5	—	Volts
DC Current Gain	V_{CE} = 5 V, I_C = 250 mA	h_{FE}	20	40	—	—

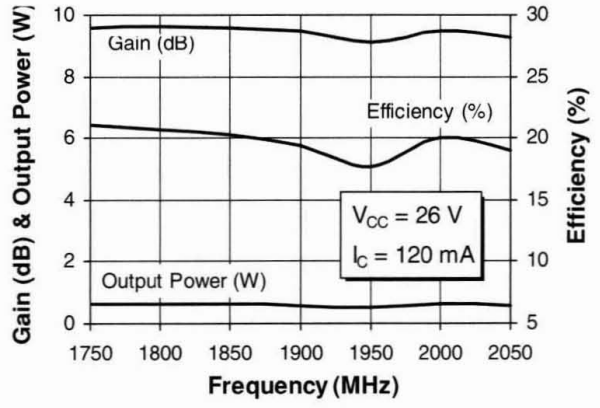
RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{CC} = 26 Vdc, P_{OUT} = 0.2 W, I_C = 120 mA, f = 2.0 GHz)	G_{pe}	8	10	—	dB
Output Power at 1 dB Compressed (V_{CC} = 26 Vdc, I_C = 120 mA, f = 2.0 GHz)	P-1dB	0.4	0.6	—	Watts
Load Mismatch Tolerance (V_{CC} = 26 Vdc, P_{OUT} = 0.2 W, I_C = 120 mA, f = 2.0 GHz—all phase angles at frequency of test)	Ψ	—	—	5:1	—

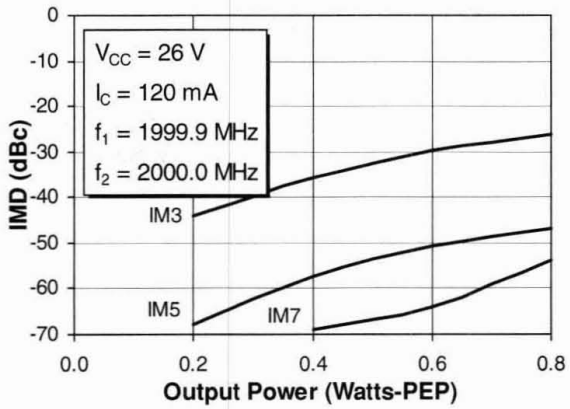
Typical Performance

3

P_{OUT}, Gain & Efficiency (at P-1dB) vs. Frequency

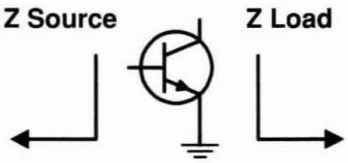


Intermodulation Distortion vs. Output Power

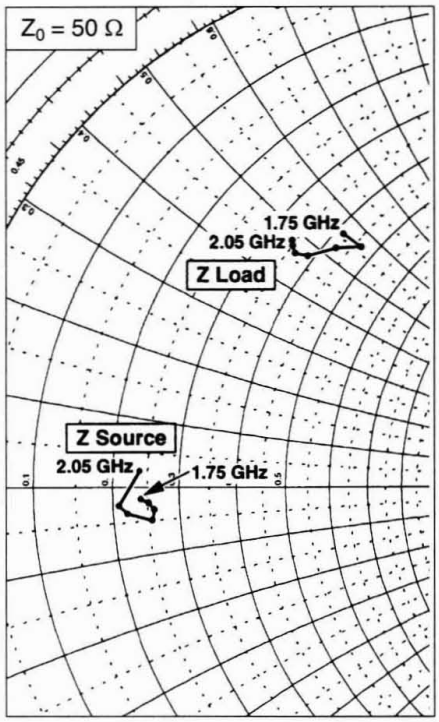


Impedance Data

V_{CC} = 26 Vdc, P_{OUT} = 0.2 W, I_C = 120 mA



Frequency	Z Source Ω		Z Load Ω	
GHz	R	jX	R	jX
1.75	12.0	-0.9	20.8	28.0
1.80	12.6	-1.2	23.3	28.3
1.85	13.0	-1.7	21.2	26.3
1.90	12.8	-2.5	19.4	23.8
1.95	11.0	-1.9	18.2	23.2
2.00	10.4	-1.3	17.5	23.7
2.05	11.9	1.2	17.2	24.0



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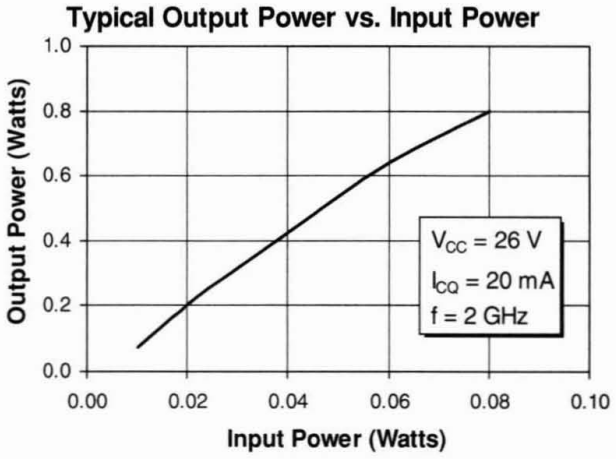
ERICSSON

PTB 20180
2.5 Watts, 1.8–2.0 GHz
Cellular Radio RF Power Transistor

Description

The PTB 20180 is a class AB, NPN, common emitter RF power transistor intended for 26 Vdc operation from 1.8 to 2.0 GHz. Rated at 2.5 watts minimum output power, it may be used for both CW and PEP applications. Ion implantation, nitride surface passivation and gold metallization are used to ensure excellent device reliability. 100% lot traceability is standard.

- 2.5 Watts, 1.8–2.0 GHz
- Class AB Characteristics
- Gold Metallization
- Silicon Nitride Passivated
- Surface Mountable
- Available in Tape and Reel



Package 20227

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CER}	50	Vdc
Collector-Base Voltage	V_{CBO}	50	Vdc
Emitter-Base Voltage (collector open)	V_{EBO}	4.0	Vdc
Collector Current (continuous)	I_C	0.5	Adc
Total Device Dissipation at T_{flange} = 25°C Above 25°C derate by	P_D	10.0 0.057	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{flange} = 70°C)	$R_{\theta JC}$	17.5	°C/W

Electrical Characteristics (100% Tested)

Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Breakdown Voltage C to E	I_B = 0 A, I_C = 10 mA, R_{BE} = 22 Ω	$V_{(BR)CER}$	50	—	—	Volts
Breakdown Voltage C to E	V_{BE} = 0 V, I_C = 5 mA	$V_{(BR)CES}$	50	—	—	Volts
Breakdown Voltage E to B	I_C = 0 A, I_E = 5 mA	$V_{(BR)EBO}$	4	5	—	Volts
DC Current Gain	V_{CE} = 5 V, I_C = 250 mA	h_{FE}	20	40	—	—

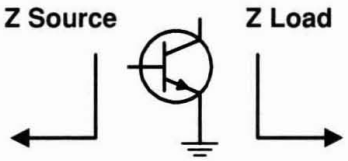
RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{CC} = 26 Vdc, P_{OUT} = 1.0 W, I_{CQ} = 20 mA, f = 2.0 GHz)	G_{pe}	8	9.5	—	dB
Power Output at 1 dB Compression (V_{CC} = 26 Vdc, I_{CQ} = 20 mA, f = 2.0 GHz)	P-1dB	2.5	4.0	—	Watts
Load Mismatch Tolerance (V_{CC} = 26 Vdc, P_{OUT} = 2.5 W, I_{CQ} = 20 mA, f = 2.0 GHz—all phase angles at frequency of test)	Ψ	—	—	5:1	—

Impedance Data (data shown for fixed-tuned broadband circuit)

3

(V_{CC} = 26 Vdc, P_{OUT} = 2.5 W, I_{CQ} = 20 mA)



Frequency	Z Source Ω		Z Load Ω	
GHz	R	jX	R	jX
1.8	28.3	-18.1	8.5	8.2
1.9	21.7	-8.0	8.0	12.5
2.0	17.2	5.9	6.5	16.3

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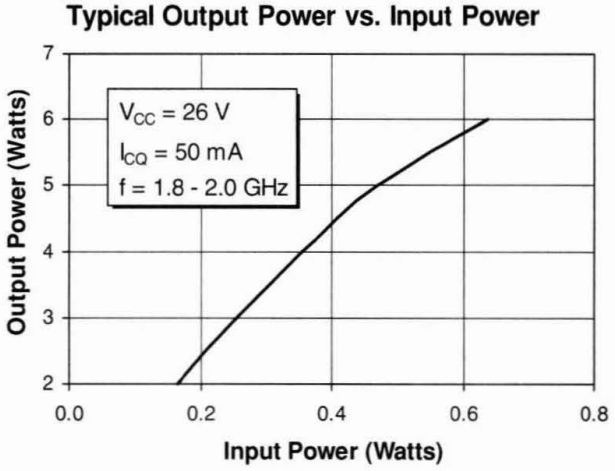
ERICSSON

PTB 20216
6 Watts, 1.8–2.0 GHz
RF Power Transistor

Description

The PTB 20216 is a class AB, NPN, common emitter RF power transistor intended for 26 Vdc operation across the 1.80 to 2.00 GHz frequency band. Rated at 6 watts minimum output power, it may be used for both CW and PEP applications. Ion implantation, nitride surface passivation and gold metallization are used to ensure excellent device reliability. 100% lot traceability is standard.

- 6 Watts, 1.80–2.00 GHz
- Class AB Characteristics
- 30% Collector Efficiency at 4 Watts
- Gold Metallization
- Silicon Nitride Passivated
- Surface Mountable
- Available in Tape and Reel



Package 20227

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CER}	50	Vdc
Collector-Emitter Voltage	V_{CES}	50	Vdc
Emitter-Base Voltage (collector open)	V_{EBO}	4.0	Vdc
Collector Current (continuous)	I_C	1.0	Adc
Total Device Dissipation at T_{flange} = 25°C Above 25°C derate by	P_D	19.7 0.112	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{flange} = 70°C)	$R_{\theta JC}$	8.9	°C/W

Electrical Characteristics (100% Tested)

Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Breakdown Voltage C to E	I_C = 10 mA, I_B = 0 A	$V_{(BR)CEO}$	20	—	—	Volts
Breakdown Voltage C to E	V_{BE} = 0 V, I_C = 10 mA	$V_{(BR)CES}$	50	—	—	Volts
Breakdown Voltage E to B	I_C = 0 A, I_E = 5 mA	$V_{(BR)EBO}$	4.0	5.0	—	Volts
DC Current Gain	V_{CE} = 5 V, I_C = 50 mA	h_{FE}	20	40	—	—

RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{CC} = 26 Vdc, P_{OUT} = 4 W, I_{CQ} = 50 mA, f = 2.0 GHz)	G_{pe}	8.0	10	—	dB
Gain (V_{CC} = 26 Vdc, P_{OUT} = 6 W, I_{CQ} = 50 mA, f = 2.0 GHz)	G_{pe}	7.0	9.0	—	dB
Collector Efficiency (V_{CC} = 26 Vdc, P_{OUT} = 4 W, I_{CQ} = 50 mA, f = 2.0 GHz)	η_C	30	—	—	%
Load Mismatch Tolerance (V_{CC} = 26 Vdc, P_{OUT} = 4 W, I_{CQ} = 50 mA, f = 2.0 GHz—all phase angles at frequency of test)	Ψ	—	—	5:1	—

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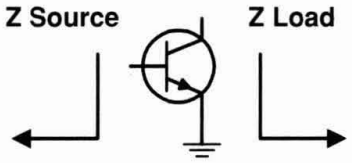
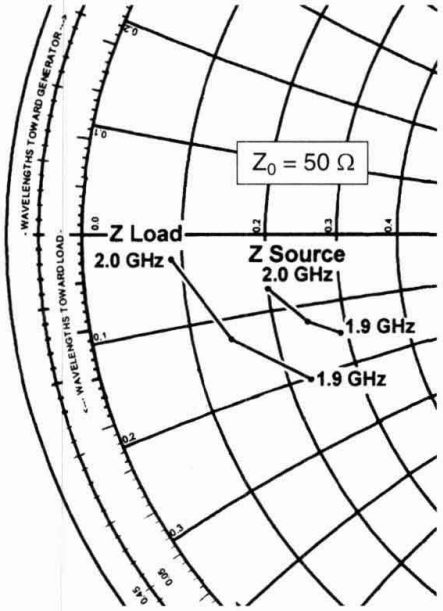
Impedance Data (data shown for fixed-tuned broadband circuit)

(V_{CC} = 26 Vdc, P_{OUT} = 4 W, I_{CQ} = 50 mA)



Frequency	Z Source Ω		Z Load Ω	
GHz	R	jX	R	jX
1.90	14.49	-7.50	11.49	-10.15
1.95	12.30	-6.16	7.23	-6.29
2.00	10.00	-3.55	4.41	-1.34



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ERICSSON

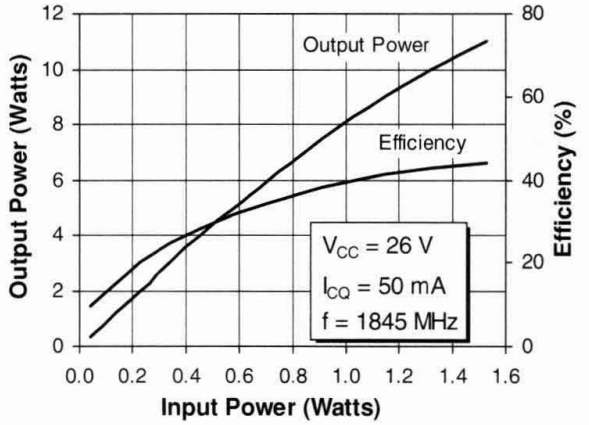
PTB 20264
10 Watts, 1.8–1.9 GHz
Cellular Radio RF Power Transistor

Description

The PTB 20264 is an NPN, common emitter RF power transistor intended for 26 Vdc class AB operation from 1.8 to 1.9 GHz. Rated at 10 watts power output, it may be used for both CW and PEP applications. Ion implantation, nitride surface passivation and gold metallization ensure excellent device reliability. 100% lot traceability.

- 26 Volt, 1.845 GHz Characteristics
  - Output Power = 10 Watts
  - Gain = 9.4 dB Typ at 5 Watts
- Class AB Characteristics
- Full Gold Metallization
- Silicon Nitride Passivated
- Surface Mountable
- Available in Tape and Reel

Typical Output Power and Efficiency vs. Input Power



Package 20243

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage, R_{BE} = 10 Ω	V_{CER}	50	Vdc
Collector-Base Voltage	V_{CBO}	50	Vdc
Emitter-Base Voltage (collector open)	V_{EBO}	4.0	Vdc
Collector Current (continuous)	I_C	2.0	Adc
Total Device Dissipation at T_{flange} = 25°C Above 25°C derate by	P_D	30 0.173	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{flange} = 70°C)	$R_{\theta JC}$	5.8	°C/W

Electrical Characteristics (100% Tested)

Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Breakdown Voltage C to E	I_B = 0 A, I_C = 10 mA	$V_{(BR)CEO}$	22	26	—	Volts
Breakdown Voltage C to E	V_{BE} = 0 V, I_C = 10 mA	$V_{(BR)CES}$	55	60	—	Volts
Breakdown Voltage E to B	I_C = 0 A, I_E = 5 mA	$V_{(BR)EBO}$	3.5	5	—	Volts
DC Current Gain	V_{CE} = 5 V, I_C = 250 mA	h_{FE}	20	50	120	—

RF Specifications (100% Tested)

Characteristic	Symbol	Min	Typ	Max	Units
Gain at P_{OUT} = 5 Watts (V_{CC} = 26 Vdc, I_{CQ} = 50 mA, f = 1805 MHz, 1845 MHz, 1880 MHz)	G_{pe}	9.0	9.4	—	dB
Gain Compression at P_{OUT} = 5 Watts (V_{CC} = 26 Vdc, I_{CQ} = 50 mA, f = 1805 MHz, 1845 MHz, 1880 MHz)	—	—	—	0.2	dB
Gain at P_{OUT} = 10 Watts (V_{CC} = 26 Vdc, I_{CQ} = 50 mA, f = 1845 MHz)	G_{pe}	8.4	—	—	dB
Gain Compression at P_{OUT} = 10 Watts (V_{CC} = 26 Vdc, I_{CQ} = 50 mA, f = 1845 MHz)	—	—	—	0.8	dB
Collector Efficiency at P_{OUT} = 10 Watts (V_{CC} = 26 Vdc, I_{CQ} = 50 mA, f = 1845 MHz)	η_C	40	—	—	%
Load Mismatch Tolerance (V_{CC} = 26 Vdc, P_{OUT} = 10 W, I_{CQ} = 50 mA, f = 1845 MHz—all phase angles at frequency of test)	Ψ	—	—	5:1	—

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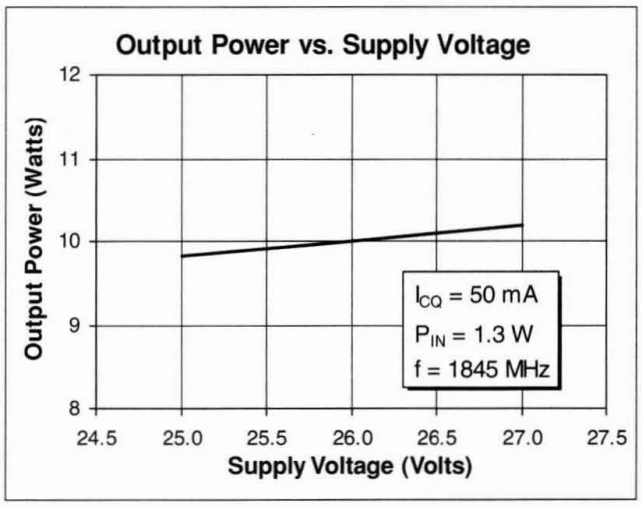
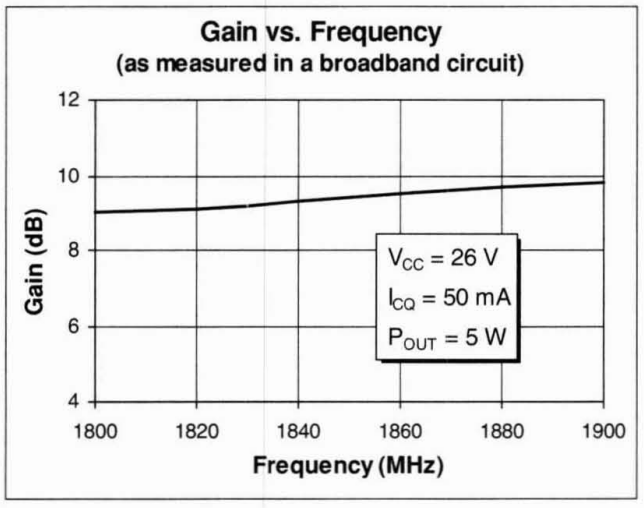
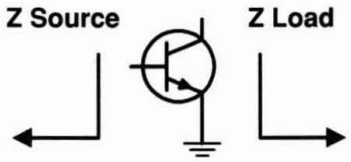
Typical Performance



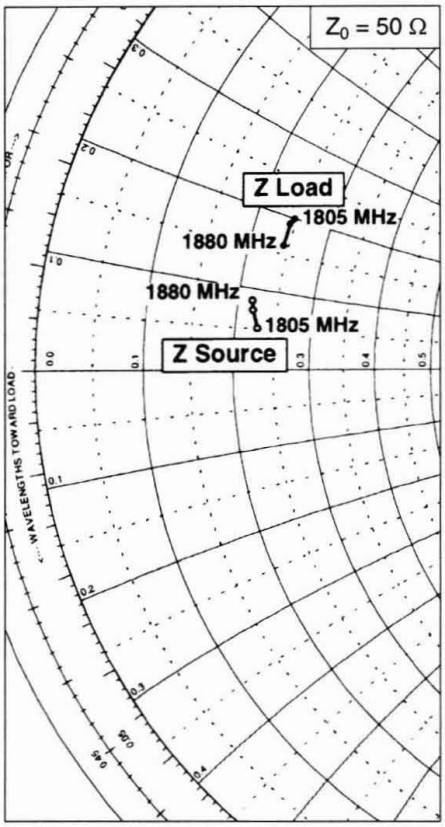


Impedance Data (data shown for fixed-tuned broadband circuit)

V_{CC} = 26 Vdc, P_{OUT} = 10 W, I_{CQ} = 50 mA



Frequency	Z Source Ω		Z Load Ω	
GHz	R	jX	R	jX
1805	11.4	2.6	12.2	8.1
1850	11.0	3.7	12.2	9.6
1880	10.9	4.3	12.4	10.6



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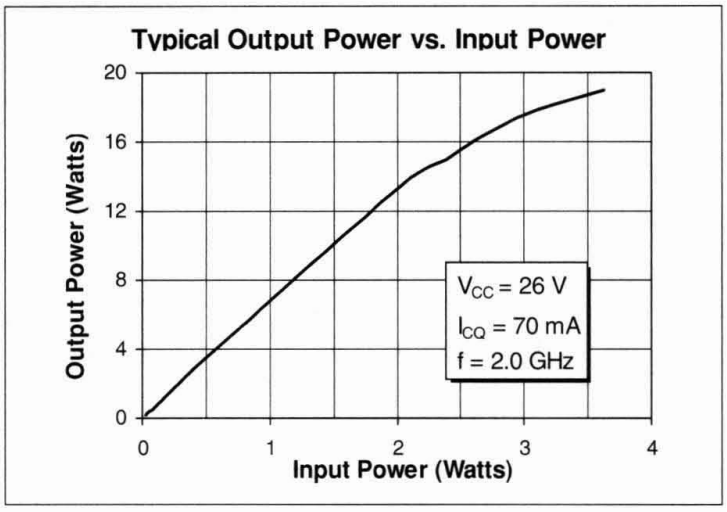
ERICSSON

PTB 20082
15 Watts, 1.8–2.0 GHz
Cellular Radio RF Power Transistor

Description

The PTB 20082 is a class AB, NPN, common emitter RF power transistor intended for 26 Vdc operation from 1.8 to 2.0 GHz. Rated at 15 watts output power, it may be used for both CW and PEP applications. Ion implantation, nitride surface passivation and gold metallization ensure excellent device reliability. 100% lot traceability is standard.

- 10 Watts Linear Power
- Output Power at 1 dB Compressed = 15 W
- Class AB Characteristics
- 30% Collector Efficiency at 7.5 Watts
- Gold Metallization
- Silicon Nitride Passivated



Package 20209

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CER}	50	Vdc
Collector-Base Voltage	V_{CBO}	50	Vdc
Emitter-Base Voltage (collector open)	V_{EBO}	4.0	Vdc
Collector Current (continuous)	I_C	1.4	Adc
Total Device Dissipation at T_{flange} = 25°C Above 25°C derate by	P_D	52 0.29	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{flange} = 70°C)	$R_{\theta JC}$	3.4	°C/W

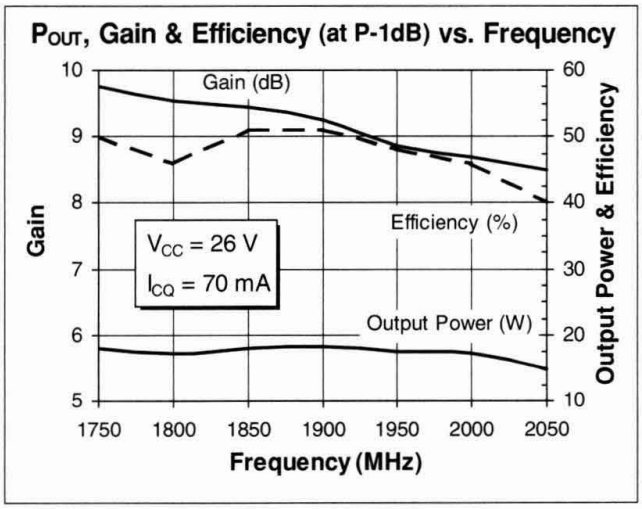
Electrical Characteristics (100% Tested)

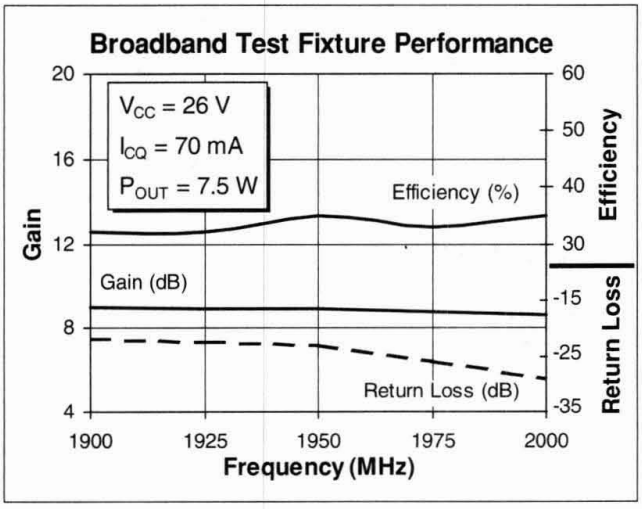
Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Breakdown Voltage C to E	I_B = 0 A, I_C = 5 mA, R_{BE} = 22 Ω	$V_{(BR)CER}$	50	—	—	Volts
Breakdown Voltage C to E	V_{BE} = 0 V, I_C = 5 mA	$V_{(BR)CES}$	50	—	—	Volts
Breakdown Voltage E to B	I_C = 0 A, I_E = 5 mA	$V_{(BR)EBO}$	4	5	—	Volts
DC Current Gain	V_{CE} = 5 V, I_C = 250 mA	h_{FE}	20	—	—	—

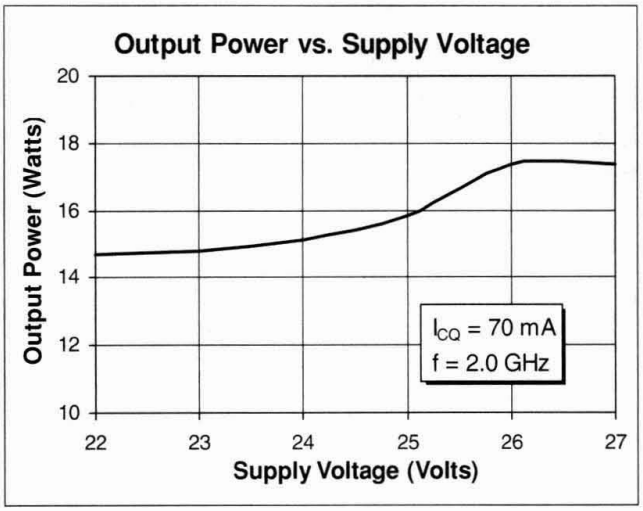
RF Specifications (100% Tested)

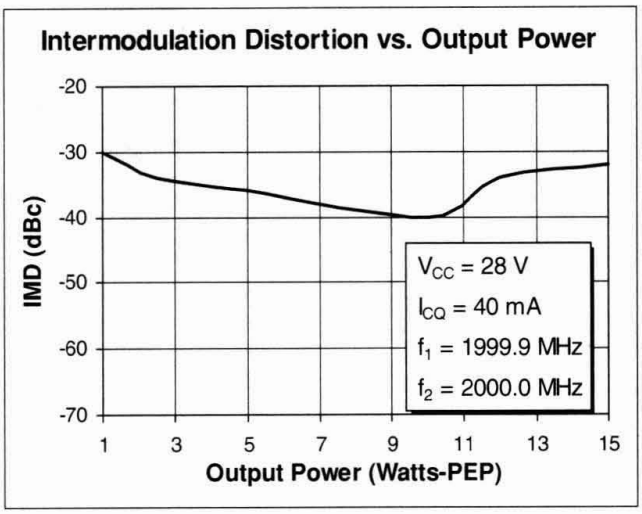
Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{CC} = 26 Vdc, P_{OUT} = 7.5 W, I_{CQ} = 70 mA, f = 2.0 GHz)	G_{pe}	8	9	—	dB
Output Power at 1 dB Compression (V_{CC} = 26 Vdc, I_{CQ} = 70 mA, f = 2.0 GHz)	P-1dB	15	—	—	Watts
Collector Efficiency (V_{CC} = 26 Vdc, P_{OUT} = 7.5 W, I_{CQ} = 70 mA, f = 2.0 GHz)	η_C	30	—	—	%
Load Mismatch Tolerance (V_{CC} = 26 Vdc, P_{OUT} = 7.5 W, I_{CQ} = 70 mA, f = 2.0 GHz—all phase angles at frequency of test)	Ψ	—	—	5:1	—

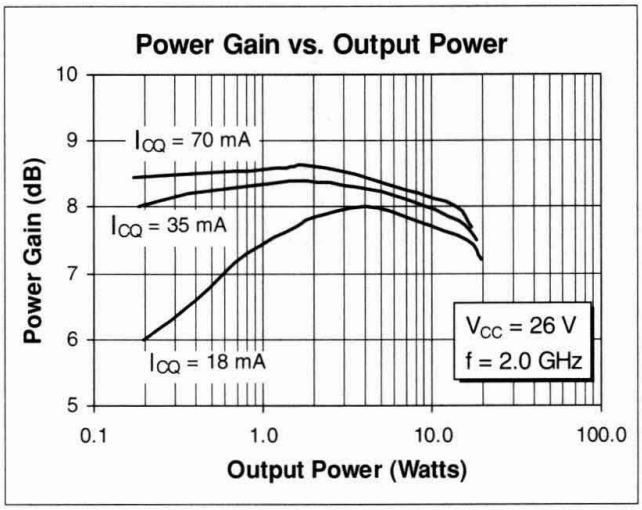
Typical Performance





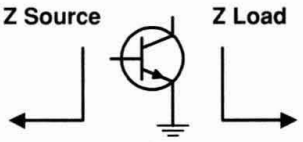




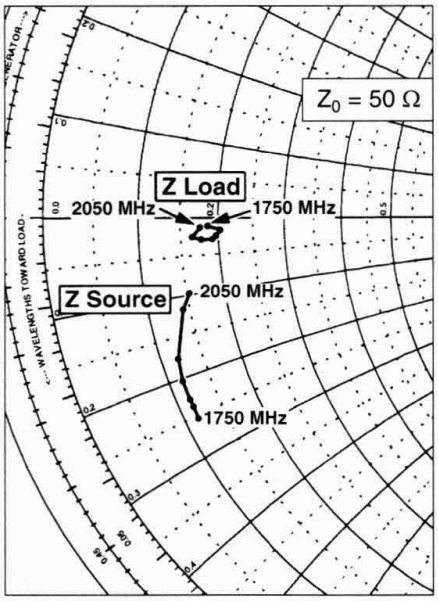


Impedance Data

V_{CC} = 26 Vdc, P_{OUT} = 7.5 W, I_{CQ} = 70 mA



Frequency	Z Source Ω		Z Load Ω	
GHz	R	jX	R	jX
1.75	5.8	-12.7	9.29	-0.6
1.80	5.8	-11.9	10.15	-0.9
1.85	5.8	-11.4	9.80	-1.3
1.90	5.8	-10.2	9.58	-1.5
1.95	6.0	-8.8	8.83	-1.5
2.00	7.1	-5.9	8.23	-1.3
2.05	7.7	-4.9	8.79	-0.7



PTB 20082

ERICSSON

Typical Scattering Parameters

(V_{CE} = 26 V, I_C = 0.5 A)

f	S11		S21		S12		S22	
(MHz)	Mag	Ang	Mag	Ang	Mag	Ang	Mag	Ang
100	0.855	-176	4.80	82	0.008	-24	0.776	-172
200	0.879	-176	3.55	75	0.007	-27	0.821	-172
300	0.931	-176	1.36	40	0.003	-29	0.911	-174
400	0.961	-178	0.558	22	0.002	31	0.962	-177
500	0.977	-179	0.157	19	0.004	78	0.985	180
600	0.984	180	0.103	145	0.006	84	1.00	177
700	0.989	178	0.263	149	0.009	81	0.998	173
800	0.992	177	0.380	142	0.012	76	0.962	170
900	0.998	176	0.476	134	0.015	72	0.931	168
1000	0.998	175	0.563	125	0.018	66	0.896	166
1100	0.997	173	0.650	116	0.021	60	0.868	165
1200	0.991	172	0.740	107	0.023	54	0.833	164
1300	0.987	170	0.847	98	0.026	50	0.791	162
1400	0.974	168	0.978	87	0.030	44	0.738	161
1500	0.950	165	1.15	75	0.035	35	0.674	161
1600	0.905	163	1.39	59	0.041	24	0.594	164
1700	0.824	160	1.67	39	0.047	7	0.523	173
1800	0.708	163	1.86	12	0.050	-18	0.552	-172
1900	0.659	173	1.83	-17	0.044	-45	0.702	-167
2000	0.731	-178	1.57	-46	0.033	-69	0.839	-171
2100	0.827	-178	1.22	-69	0.023	-91	0.892	-178
2200	0.889	-180	0.919	-85	0.016	-114	0.894	178

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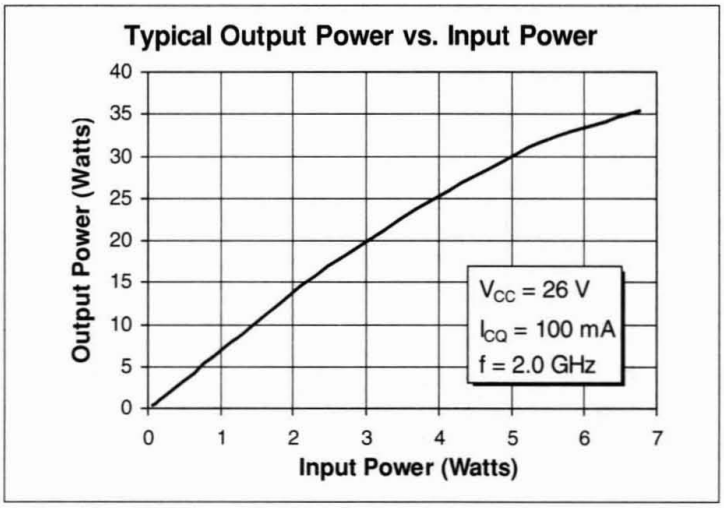
ERICSSON

PTB 20170
30 Watts, 1.8–2.0 GHz
Cellular Radio RF Power Transistor

Description

The PTB 20170 is a class AB, NPN, common emitter RF power transistor intended for 26 Vdc operation from 1.8 to 2.0 GHz. Rated at 30 watts power output, it may be used for both CW and PEP applications. Ion implantation, nitride surface passivation and gold metallization are used to ensure excellent device reliability. 100% lot traceability.

- 30 Watts, 1.8–2.0 GHz
- Class AB Characteristics
- Full Gold Metallization
- Silicon Nitride Passivated



Package 20209

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Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CER}	55	Vdc
Collector-Emitter Voltage	V_{CES}	55	Vdc
Emitter-Base Voltage (collector open)	V_{EBO}	4.0	Vdc
Collector Current (continuous)	I_C	6.7	Adc
Total Device Dissipation at T_{flange} = 25°C Above 25°C derate by	P_D	123 0.7	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{flange} = 70°C)	$R_{\theta JC}$	1.43	°C/W

Electrical Characteristics (100% Tested)

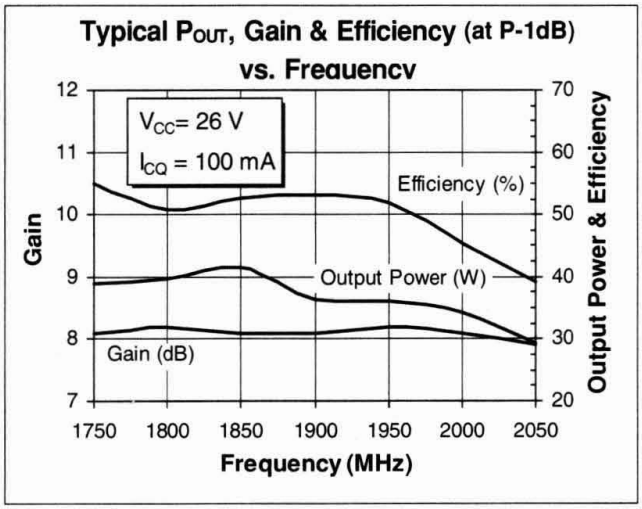
Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Breakdown Voltage C to E	I_C = 50 mA, R_{BE} = 27 Ω	$V_{(BR)CER}$	55	—	—	Volts
Breakdown Voltage C to E	V_{BE} = 0 V, I_C = 50 mA	$V_{(BR)CES}$	55	—	—	Volts
Breakdown Voltage E to B	I_C = 0 A, I_E = 5 mA	$V_{(BR)EBO}$	4	5	—	Volts
DC Current Gain	V_{CE} = 5 V, I_C = 250 mA	h_{FE}	20	50	120	—

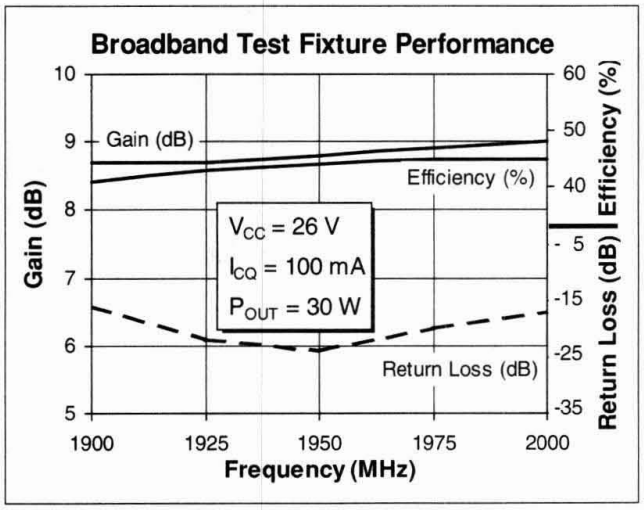
RF Specifications (100% Tested)

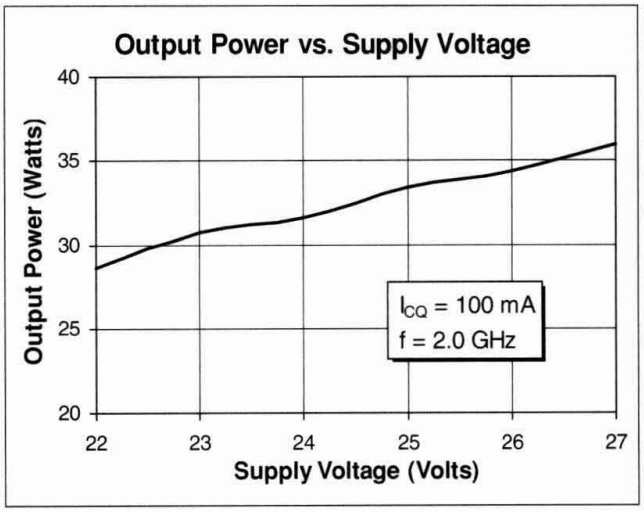
Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{CC} = 26 Vdc, P_{OUT} = 30 W, I_{CQ} = 100 mA, f = 2.0 GHz)	G_{pe}	7.0	8.5	—	dB
Collector Efficiency (V_{CC} = 26 Vdc, P_{OUT} = 30 W, I_{CQ} = 100 mA, f = 2.0 GHz)	η_C	38	46	—	%
Load Mismatch Tolerance (V_{CC} = 26 Vdc, P_{OUT} = 30 W(PEP), I_{CQ} = 100 mA, f = 2.0 GHz—all phase angles at frequency of test)	Ψ	—	—	5:1	—

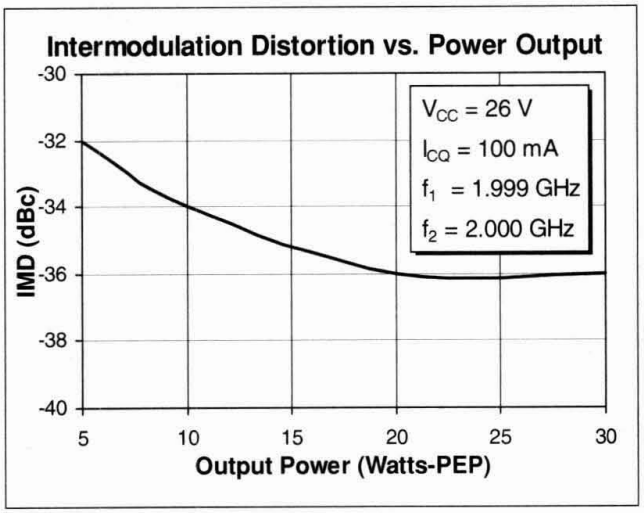
Typical Performance

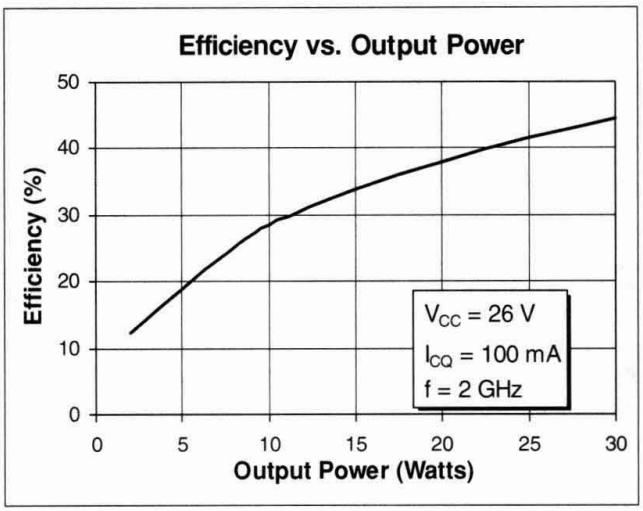
3

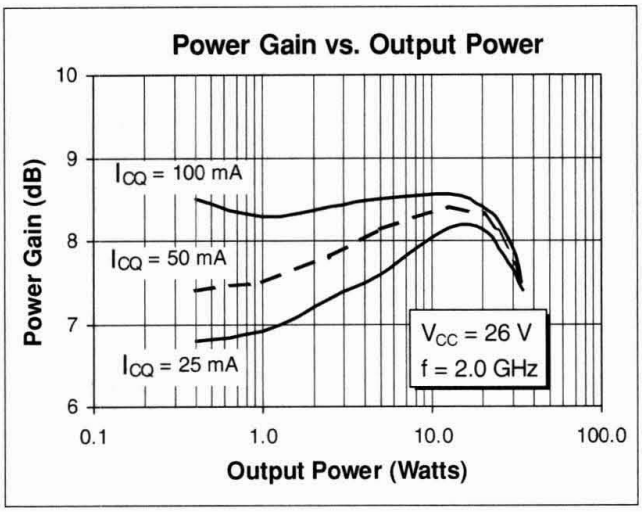






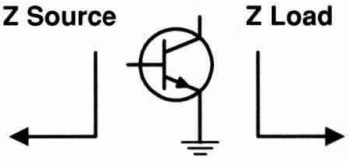




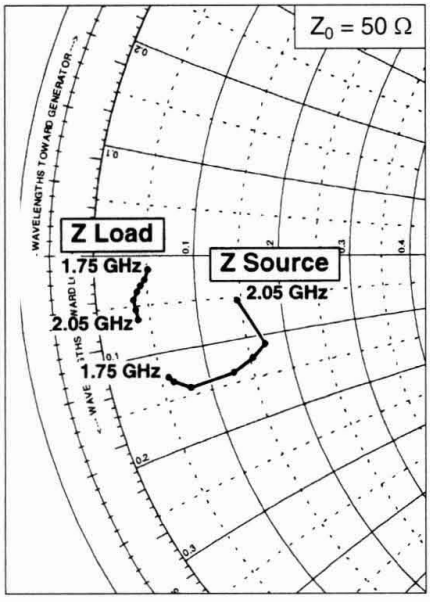


Impedance Data

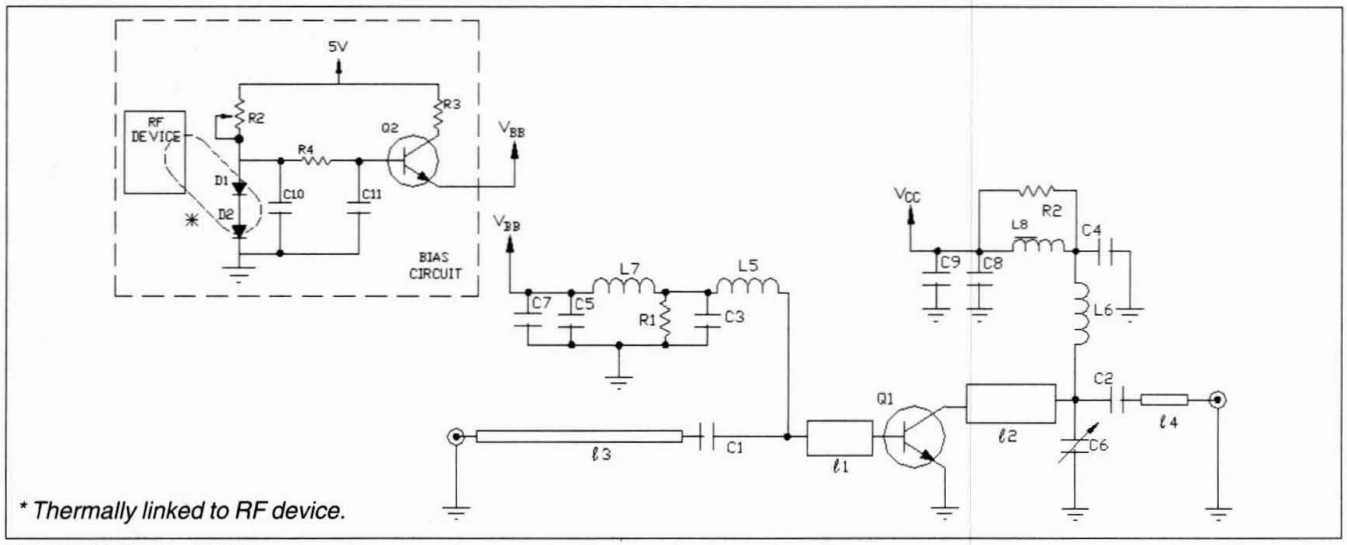
(V_{CC} = 26 Vdc, P_{OUT} = 30 W, I_{CQ} = 100 mA)



Frequency	Z Source Ω		Z Load Ω	
GHz	R	jX	R	jX
1.75	2.9	-6.3	2.60	-0.7
1.80	3.1	-6.6	2.40	-1.2
1.85	3.9	-7.1	2.20	-1.5
1.90	6.4	-7.8	2.00	-1.8
1.95	7.7	-6.3	1.80	-2.2
2.00	8.6	-5.6	1.85	-2.7
2.05	7.3	-2.7	1.92	-3.2

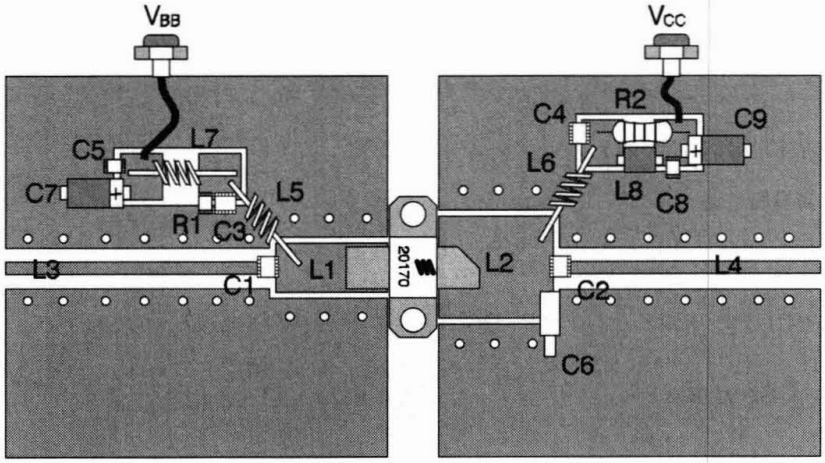


Test Circuit

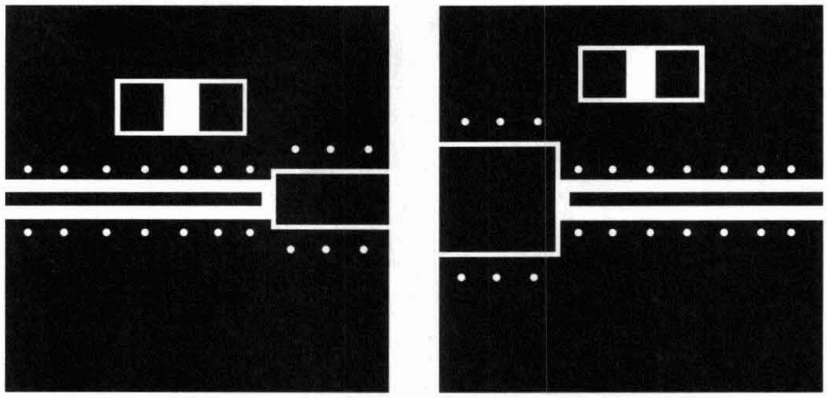


Schematic for f = 2 GHz

Q1	PTB 20170, NPN RF Transistor		R1	22 Ω 118 W SMT Resistor	
L1	.185 λ 2GHz, Microstrip 18 Ω		R2	12 Ω .5 W Axial Resistor	
L1	.195 λ 2GHz, Microstrip 9.5 Ω		Circuit Board	.028" Dielectric Thickness, ε_r = 4.0, AlliedSignal, G200, 2 oz. copper	
L5, L6	4 Turn #20 AWG, .120" I.D.				
L7	56 μA SMT Inductor		*Bias Parts (not shown on layout)*		
L8	Ferrite Bead		Q2	BCP 56	SMT NPN Transistor
C1, C2,	33 pF ATC-B		D1	BAV 99	Diode
C3, C4	33 pF ATC-B		C10, C11	0.1 pF	SMT Capacitor
C5, C7	0.1 υF, 1206		R2	2K	Potentiometer
C6, C8	10 pF SMT Electrolytic Capacitor		R3, R4	10 Ω	1206 SMT Resistor
C9	0–4 pF Johanson Variable Capacitor				



Board Assembly (not to scale)



Artwork (1 inch ——— *)*

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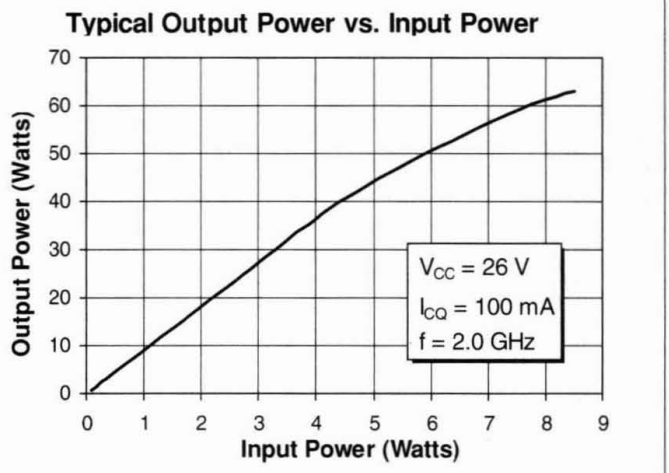
PTB 20151
45 Watts, 1.8–2.0 GHz
PCN/PCS Power Transistor

Description

The PTB 20151 is a class AB, NPN common emitter RF power transistor intended for 26 Vdc operation from 1.8 to 2.0 GHz. Rated at 45 watts power output for PEP applications, it is specifically intended for operation as a final or driver stage in CDMA or TDMA systems. Ion implantation, nitride surface passivation and gold metallization ensure excellent device reliability. 100% lot traceability.

- 45 Watts, 1.8–2.0 GHz
- Class AB Characteristics
- 40% Collector Efficiency at 45 W
- Full Gold Metallization
- Silicon Nitride Passivated



Package 20223

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CER}	50	Vdc
Collector-Base Voltage	V_{CBO}	50	Vdc
Emitter-Base Voltage (collector open)	V_{EBO}	4.0	Vdc
Collector Current (continuous)	I_C	7.7	Adc
Total Device Dissipation at T_{flange} = 25° C Above 25°C derate by	P_D	200 1.2	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{flange} = 70° C)	$R_{\theta JC}$	0.85	°C/W

PTB 20151

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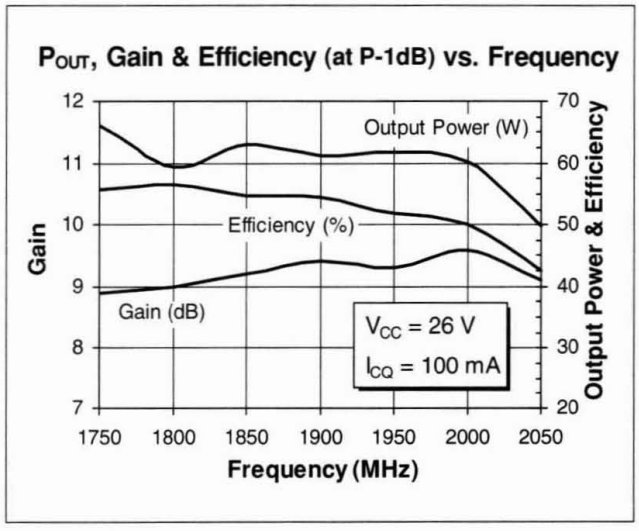
Electrical Characteristics (100% Tested)

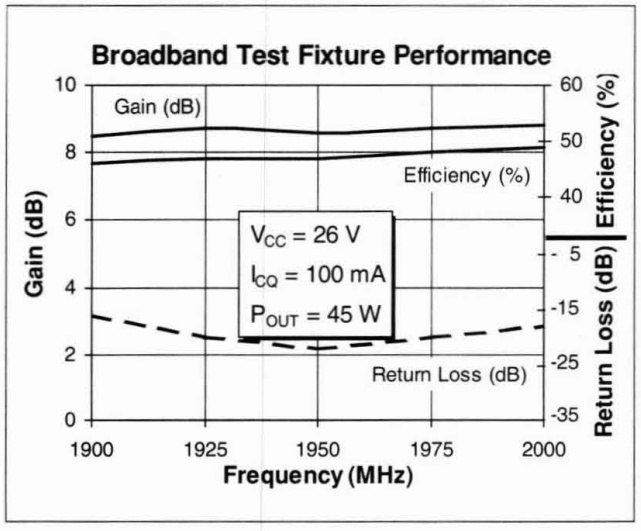
Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Breakdown Voltage C to E	V_{BE} = 0 V, I_C = 100 mA	$V_{(BR)CES}$	50	—	—	Volts
Breakdown Voltage C to E	I_B = 0 A, I_C = 100 mA, R_{BE} = 22 Ω	$V_{(BR)CER}$	50	—	—	Volts
Breakdown Voltage E to B	I_C = 0 A, I_E = 5 mA	$V_{(BR)EBO}$	4.0	5.0	—	Volts
DC Current Gain	V_{CE} = 5 V, I_C = 1 A	h_{FE}	20	40	—	—

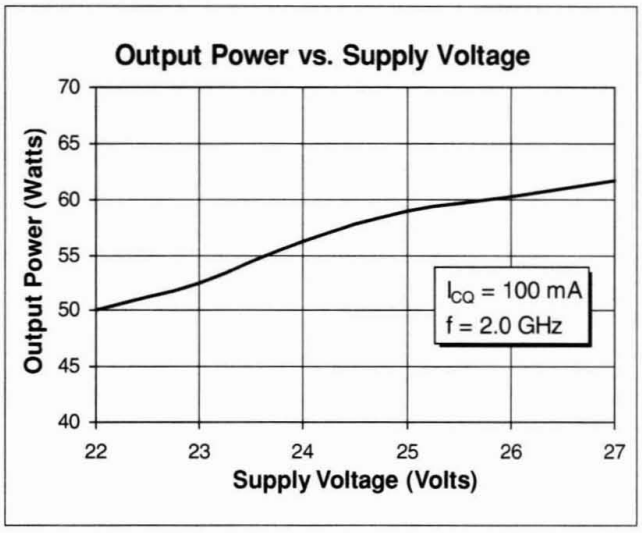
RF Specifications (100% Tested)

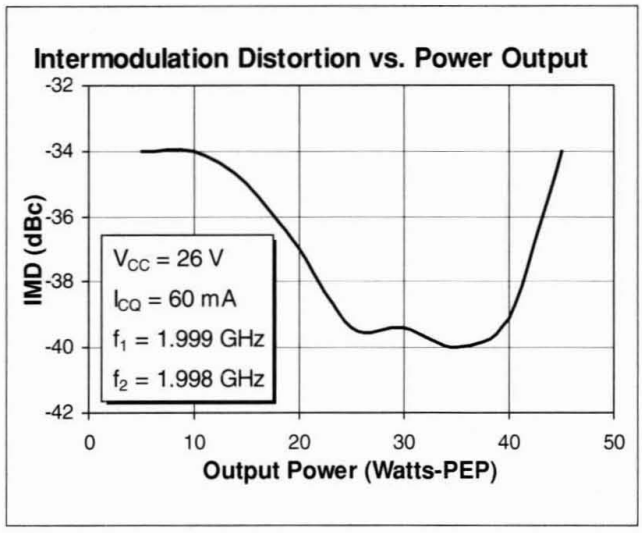
Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{CC} = 26 Vdc, P_{OUT} = 10 W, I_{CQ} = 100 mA, f = 2 GHz)	G_{pe}	8.0	9.5	—	dB
Power Output at 1 dB Compression (V_{CC} = 26 Vdc, P_{OUT} = 45 W, I_{CQ} = 100 mA, f = 2 GHz)	P-1dB	45.0	—	—	Watts
Collector Efficiency (V_{CC} = 26 Vdc, P_{OUT} = 45 W, I_{CQ} = 100 mA, f = 2 GHz)	η_C	40	47	—	%
Load Mismatch Tolerance (V_{CC} = 26 Vdc, P_{OUT} = 22.5 W, I_{CQ} = 100 mA, f = 2 GHz—all phase angles at frequency of test)	Ψ	—	—	5:1	—

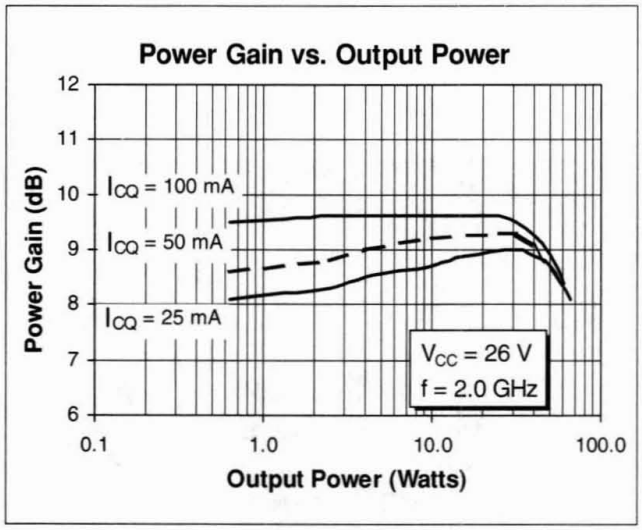
Typical Performance





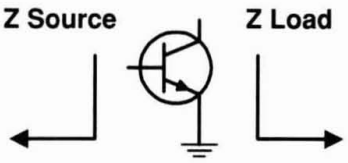




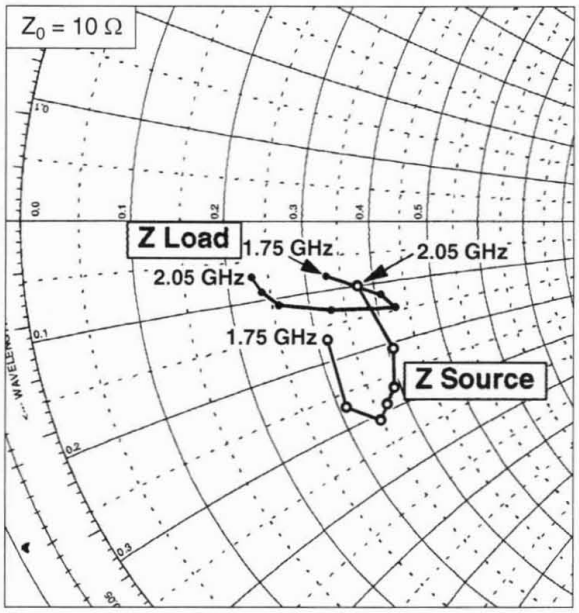


Impedance Data

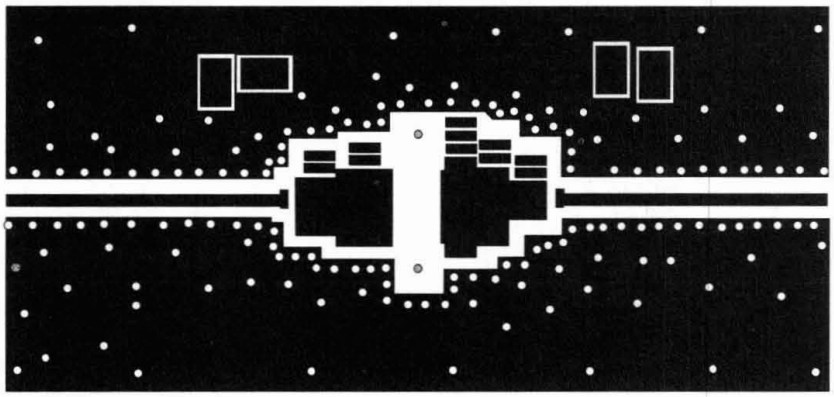
(V_{CC} = 26 Vdc, P_{OUT} = 45 W, I_{CQ} = 100 mA)



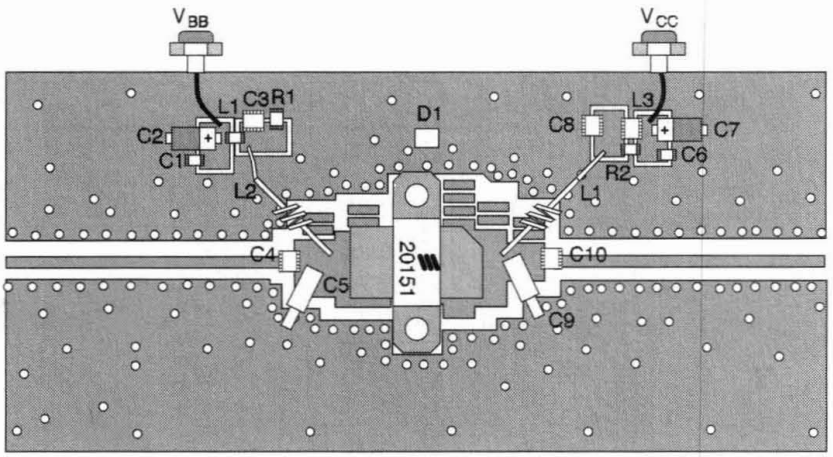
Frequency	Z Source Ω		Z Load Ω	
GHz	R	jX	R	jX
1.75	3.15	-1.7	3.3	-0.8
1.80	3.10	-2.7	4.1	-1.2
1.85	3.50	-3.1	4.3	-1.5
1.90	3.70	-2.9	3.3	-1.3
1.95	3.90	-2.7	2.6	-1.1
2.00	4.10	-2.1	2.4	-0.9
2.05	3.75	-1.0	2.3	-0.7



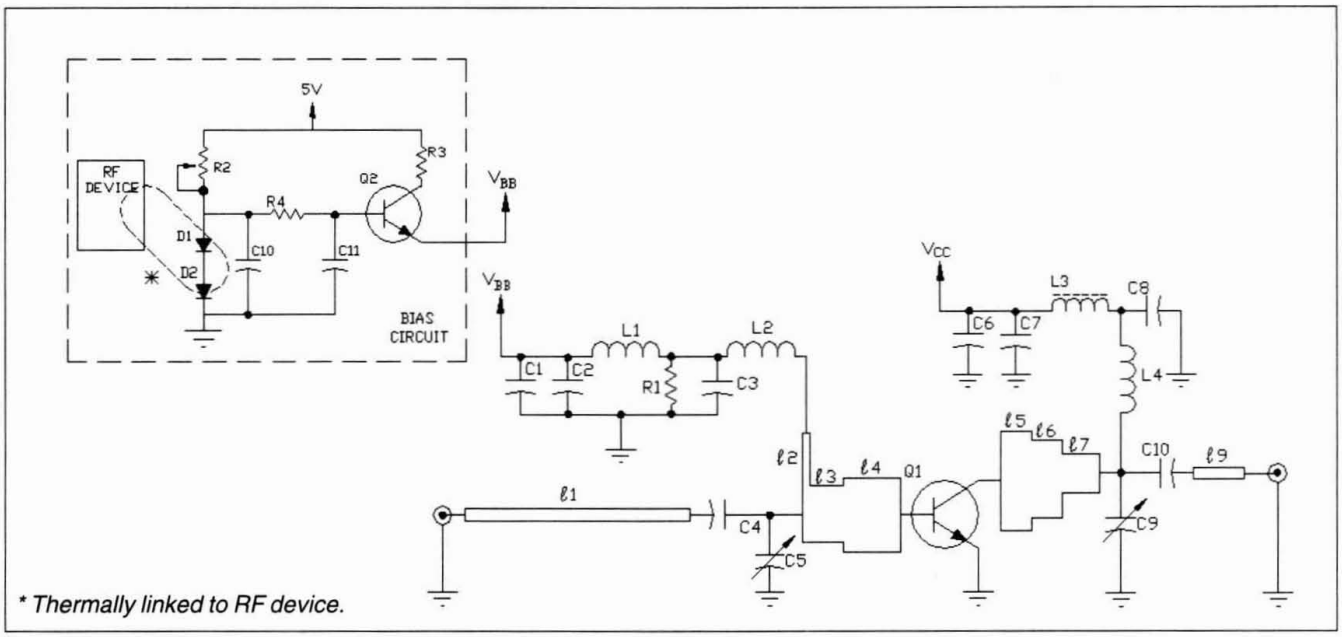
Test Circuit



Artwork (1 inch)



Parts Layout (not to scale)



** Thermally linked to RF device.*

Schematic for f = 2 GHz

Q1	PTB 20151	NPN RF Transistor
ℓ1, ℓ9		Microstrip 50 Ω
ℓ2	.1 λ 2 GHz	Microstrip 75 Ω
ℓ3	.065 λ 2 GHz	Microstrip 16 Ω
ℓ4	.095 λ 2 GHz	Microstrip 12.5 Ω
ℓ5	.055 λ 2 GHz	Microstrip 9.7 Ω
ℓ6	.055 λ 2 GHz	Microstrip 12.5 Ω
ℓ7	.065 λ 2 GHz	Microstrip 22 Ω
C1, C6	0.1 μF	1206 Chip
C2, C7	10 μF, 35 V	SMT Tantalum
C3, C4, C8, C10	20 pF	ATC-100
C5, C9	0–4 pf	Johanson Trimmer

L1	56 nh	SMT Inductor
L2, L4	3 Turn #22, 0.25" O.D.	
L3	4 mm.	SMT Ferrite
R1	22 Ω	1206 SMT Resistor
Circuit Board	.028" Dielectric Thickness, ε_r = 4.0, AlliedSignal, G200, 2 oz. copper	

Bias Parts (not shown on layout)

Q2	BCP 56	SMT NPN Transistor
D1	BAV 99	Diode
C10, C11	0.1 pF	SMT Capacitor
R2	2K	Potentiometer
R3, R4	10 Ω	1206 SMT Resistor

3

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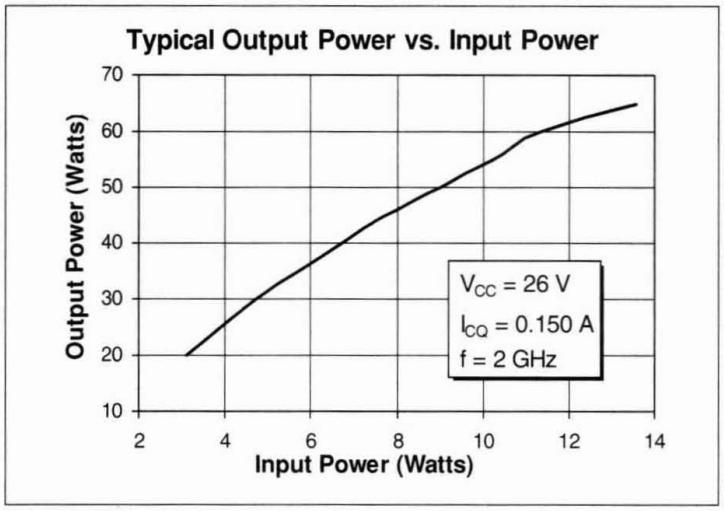
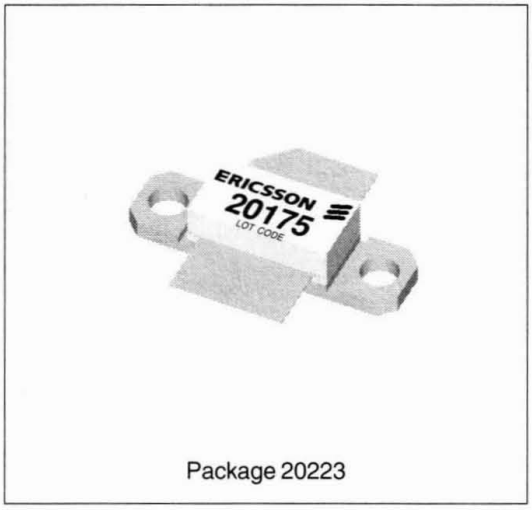
PTB 20175
55 Watts, 1.9–2.0 GHz
Cellular Radio RF Power Transistor

Description

The PTB 20175 is a class AB, NPN common emitter RF power transistor intended for 26 Vdc operation from 1.9 to 2.0 GHz. It is rated at 55 watts minimum output power and may be used for both CW and PEP applications. Ion implantation, nitride surface passivation and gold metallization are used to ensure excellent device reliability. 100% lot traceability is standard.

- 55 Watts, 1.9–2.0 GHz
- Class AB Characteristics
- 40% Collector Efficiency at 55 Watts
- Gold Metallization
- Silicon Nitride Passivated





Package 20223

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CER}	55	Vdc
Collector-Emitter Voltage	V_{CES}	55	Vdc
Emitter-Base Voltage (collector open)	V_{EBO}	4	Vdc
Collector Current (continuous)	I_C	8	Adc
Total Device Dissipation at T_{flange} = 25° C Above 25°C derate by	P_D	233 1.33	W W/°C
Storage Temperature Range	Tstg	–40 to +150	°C
Thermal Resistance (T_{flange} = 70° C)	$R_{\theta JC}$	.75	°C/W

PTB 20175

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Electrical Characteristics (100% Tested)

Characteristics	Conditions	Symbol	Min	Typ	Max	Units
Breakdown Voltage C to E	Ic = 60 mA, R_B = 27 Ω	$V_{(BR)CER}$	55	—	—	Volts
Breakdown Voltage C to E	V_{BE} = 0 V, I_C = 60 mA	$V_{(BR)CES}$	55	—	—	Volts
Breakdown Voltage E to B	I_C = 0 V, I_E = 25 mA	$V_{(BR)EBO}$	4.0	5	—	Volts
DC Current Gain	V_{CE} = 5 V, I_C = 300 mA	H_{fe}	—	50	—	—

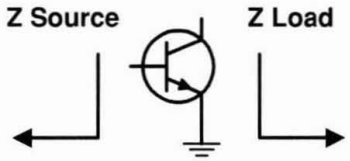
RF Specifications (100% Tested)

Characteristics	Symbol	Min	Typ	Max	Units
Gain (V_{CC} = 26 Vdc, P_{OUT} = 55 W, I_{CQ} = 150 mA, f = 2.0 GHz)	G_{pe}	7.0	7.6	—	dB
Collector Efficiency (V_{CC} = 26 Vdc, P_{OUT} = 55 W, I_{CQ} = 150 mA, f = 2.0 GHz)	η_C	37	47	—	%
Load Mismatch Tolerance (V_{CC} = 26 Vdc, P_{OUT} = 55 W(PEP), I_{CQ} = 150 mA, f = 2.0 GHz—All Phase Angles at Frequency of Test)	Ψ	—	—	5:1	—

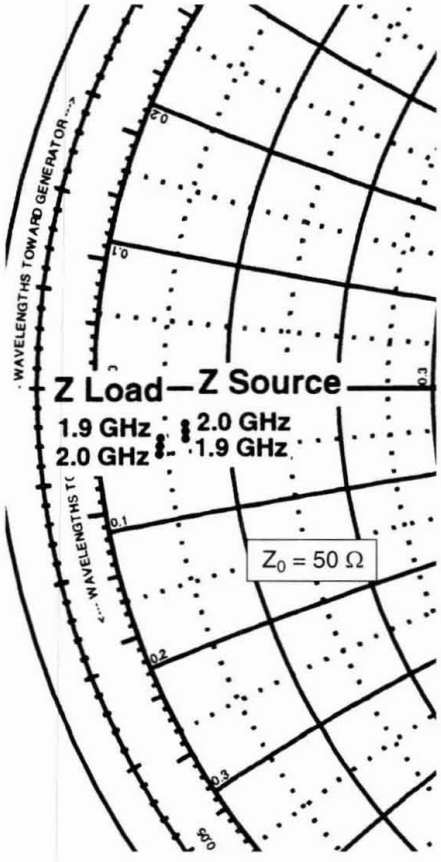
3

Impedance Data (data shown for fixed-tuned broadband circuit)

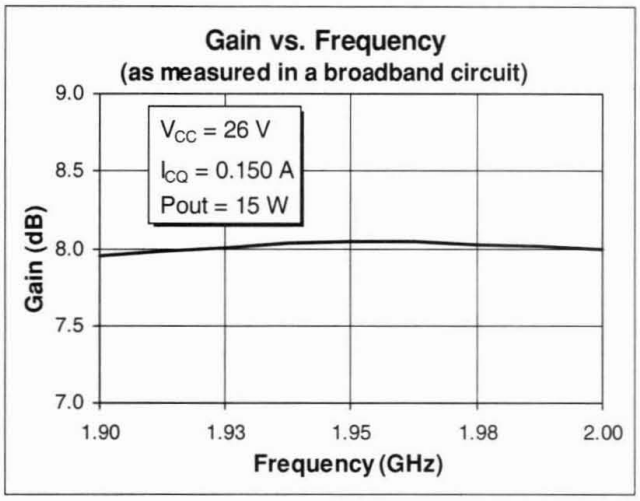
(V_{CC} = 26 Vdc, P_{OUT} = 55 W, I_{CQ} = 150 mA)

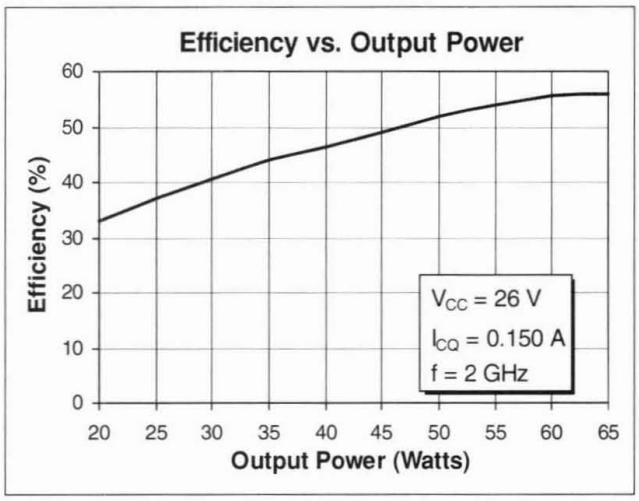


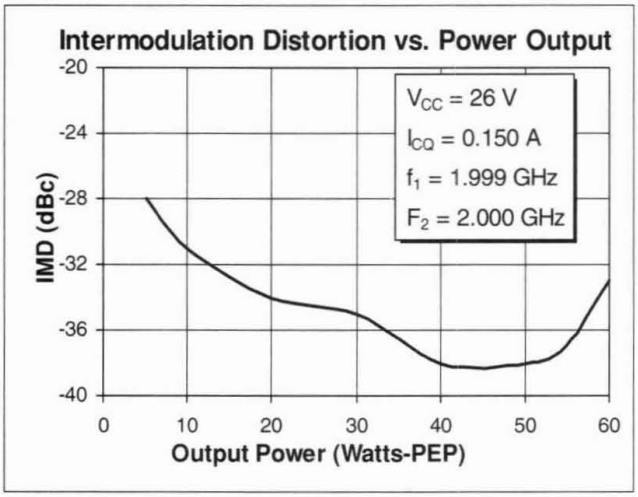
Frequency	Z Source Ω		Z Load Ω	
GHz	R	jX	R	jX
1.90	3.26	-2.0	2.30	-1.9
1.95	3.26	-1.7	2.25	-2.2
2.00	3.26	-1.4	2.20	-2.5



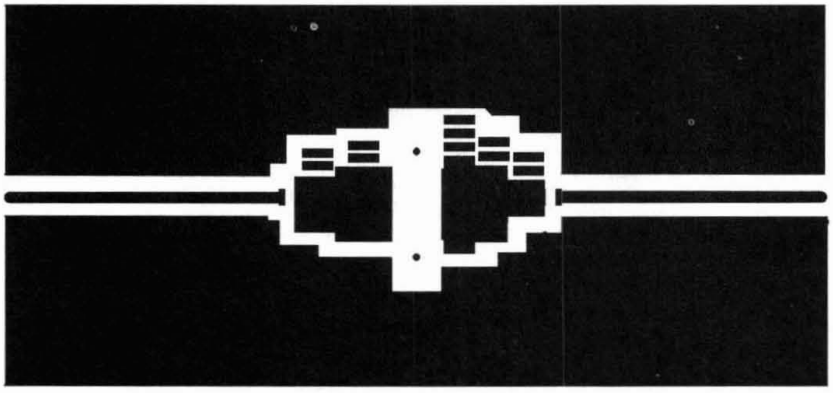
Typical Performance







Test Circuit



Artwork (1 inch *)*

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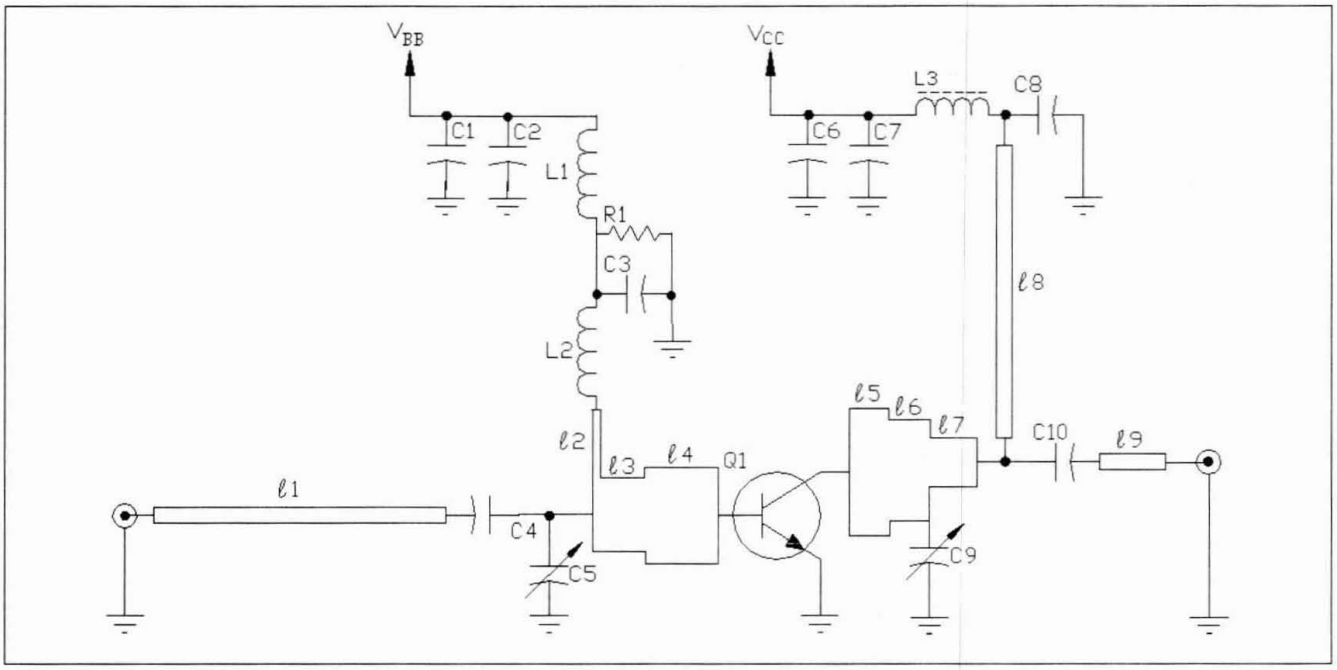

Schematic for f = 2 GHz

Q1	PTB 20175	NPN RF Transistor
ℓ1		Microstrip 50 Ω
ℓ2	.1 λ 2 GHz	Microstrip 75 Ω
ℓ3	.065 λ 2 GHz	Microstrip 16 Ω
ℓ4	.095 λ 2 GHz	Microstrip 10.8 Ω
ℓ5	.055 λ 2 GHz	Microstrip 8.0 Ω
ℓ6	.055 λ 2 GHz	Microstrip 12.5 Ω
ℓ7	.065 λ 2 GHz	Microstrip 22 Ω
ℓ8	.25 λ 2 GHz	Microstrip 60 Ω
ℓ9		Microstrip 50 Ω

C1, C6	.1 μF	1206 Chip
C2, C7	10 μF, 35 V	SMT Tantalum
C3, C4, C8, C10	33 pF	ATC-100
C5, C9	0 - 4 pf	Johanson Trimmer
L1	56 nh	SMT Inductor
L2	6.8 nh	SMT Inductor
L3	4 mm.	SMT Ferrite
R1	22 Ω	1206 Chip
Circuit Board	.028" Dielectric Thickness, ε_r = 4.0, AlliedSignal, G200, 2 oz. copper	

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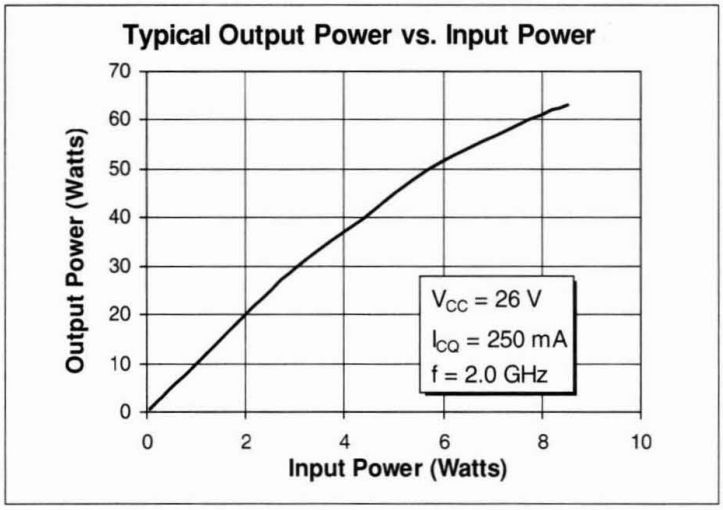
ERICSSON

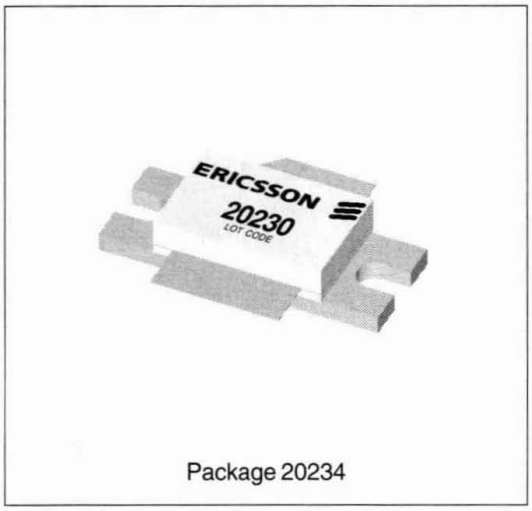
PTB 20230
45 Watts, 1.8–2.0 GHz
PCN/PCS Power Transistor

Description

The PTB 20230 is a class AB, NPN common emitter RF power transistor intended for 26 Vdc operation from 1.8 to 2.0 GHz. Rated at 45 watts minimum output power for PEP applications, it is specifically intended for operation as a final or driver stage in CDMA or TDMA systems. Ion implantation, nitride surface passivation and gold metallization ensure excellent device reliability. 100% lot traceability is standard.

- 45 Watts, 1.8–2.0 GHz
- Class AB Characteristics
- 45% Collector Efficiency at 45 Watts
- Gold Metallization
- Silicon Nitride Passivated





Package 20234

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CER}	55	Vdc
Collector-Base Voltage	V_{CBO}	55	Vdc
Emitter-Base Voltage (collector open)	V_{EBO}	4.0	Vdc
Collector Current (continuous)	I_C	7.7	Adc
Total Device Dissipation at T_{flange} = 25° C Above 25°C derate by	P_D	200 1.2	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{flange} = 70° C)	$R_{\theta JC}$	0.85	°C/W

Electrical Characteristics (100% Tested)

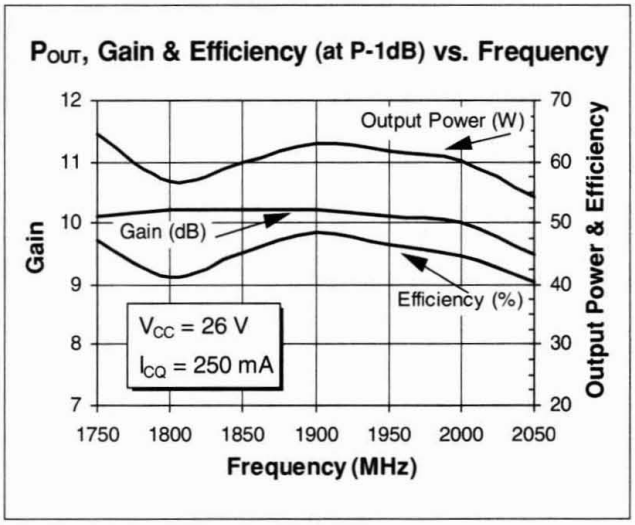
Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Breakdown Voltage C to E	V_{BE} = 0 V, I_C = 100 mA	$V_{(BR)CES}$	55	—	—	Volts
Breakdown Voltage C to E	I_B = 0 A, I_C = 100 mA, R_{BE} = 22 Ω	$V_{(BR)CER}$	55	—	—	Volts
Breakdown Voltage E to B	I_C = 0 A, I_E = 5 mA	$V_{(BR)EBO}$	4.0	5.0	—	Volts
DC Current Gain	V_{CE} = 5 V, I_C = 1 A	h_{FE}	20	40	—	—

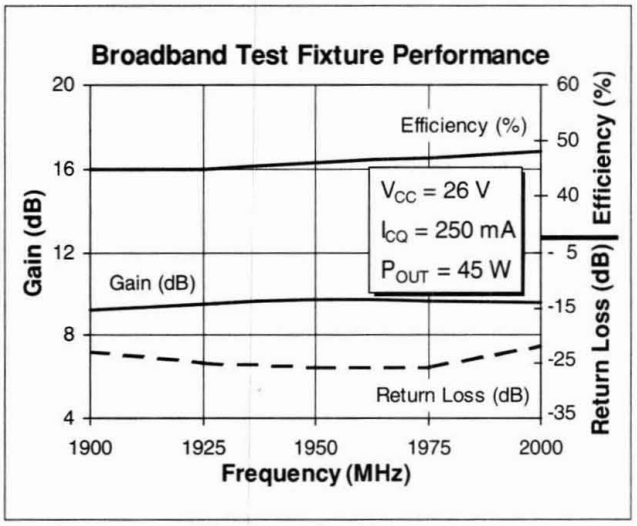
RF Specifications (100% Tested)

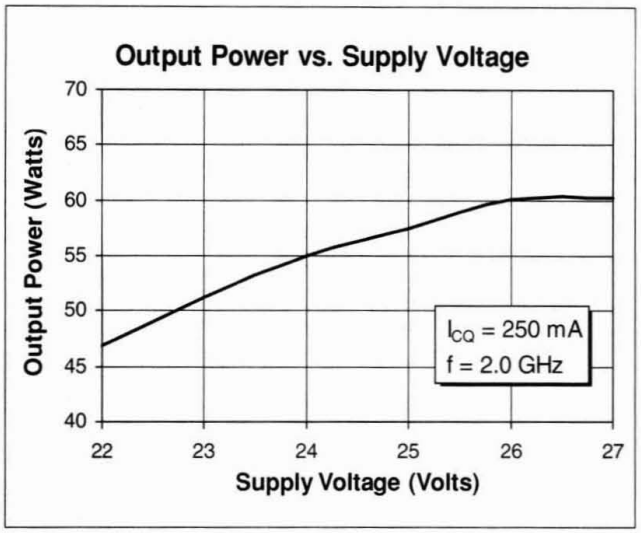
Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{CC} = 26 Vdc, P_{OUT} = 45 W, I_{CQ} = 250 mA, f = 2 GHz)	G_{pe}	8.5	9.5	—	dB
Power Output at 1 dB Compression (V_{CC} = 26 Vdc, I_{CQ} = 250 mA, f = 2 GHz)	P-1dB	45	—	—	Watts
Input Return Loss (V_{CC} = 26 Vdc, P_{OUT} = 45 W, I_{CQ} = 250 mA, f = 2 GHz)	Rtn Loss	10	—	—	dB
Collector Efficiency (V_{CC} = 26 Vdc, P_{OUT} = 45 W, I_{CQ} = 250 mA, f = 2 GHz)	η_C	45	50	—	%
Load Mismatch Tolerance (V_{CC} = 26 Vdc, P_{OUT} = 45 W, I_{CQ} = 250 mA, f = 2 GHz—all phase angles at frequency of test)	Ψ	—	—	3:1	—

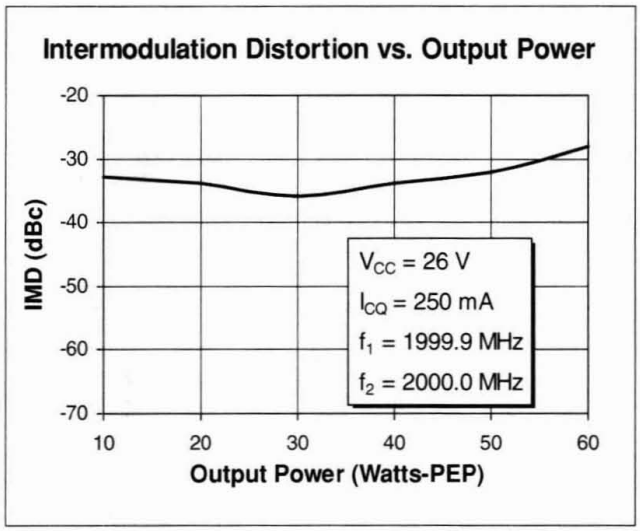
3

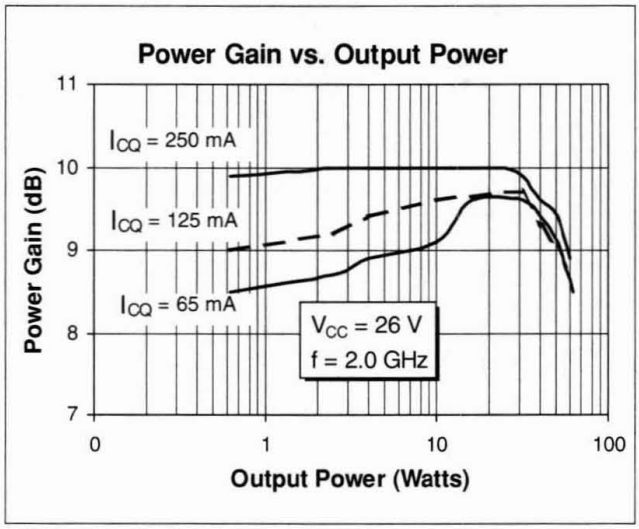
Typical Performance











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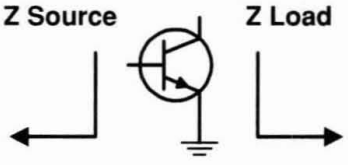
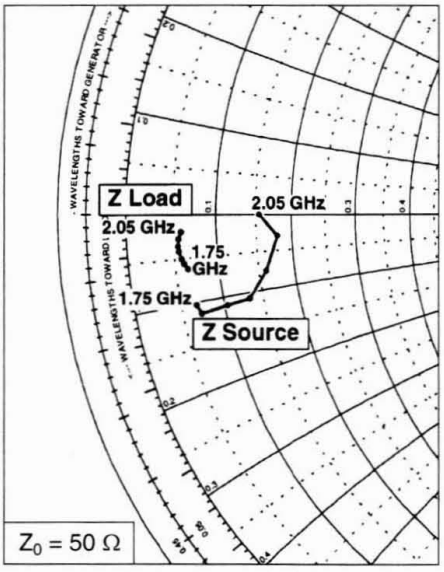
Impedance Data

V_{CC} = 26 Vdc, P_{OUT} = 45 W, I_{CQ} = 250 mA



Frequency	Z Source Ω		Z Load Ω	
GHz	R	jX	R	jX
1.75	3.36	-5.20	3.20	-3.10
1.80	3.57	-5.70	3.00	-2.80
1.85	5.14	-5.55	2.90	-2.50
1.90	6.60	-5.40	2.77	-2.10
1.95	8.00	-3.80	2.75	-1.80
2.00	8.95	-1.50	2.80	-1.40
2.05	7.72	0.00	2.95	-1.00



Typical Scattering Parameters

(V_{CE} = 26 V, I_C = 1.75 A)

f	S11		S21		S12		S22	
(MHz)	Mag	Ang	Mag	Ang	Mag	Ang	Mag	Ang
100	0.936	-179	1.44	77	0.002	6	0.798	-172
200	0.946	-179	1.06	70	0.002	23	0.828	-174
300	0.963	-180	0.397	34	0.003	71	0.883	-174
400	0.970	179	0.194	19	0.004	85	0.924	-175
500	0.972	179	0.100	11	0.006	89	0.943	-177
600	0.971	178	0.046	12	0.009	88	0.982	-179
700	0.972	178	0.014	55	0.011	84	1.00	177
800	0.975	178	0.026	130	0.012	83	0.952	175
900	0.980	177	0.048	137	0.014	83	0.923	174
1000	0.980	177	0.069	135	0.017	80	0.895	174
1100	0.984	176	0.090	132	0.019	74	0.898	175
1200	0.986	176	0.113	128	0.019	72	0.897	174
1300	0.994	175	0.144	124	0.020	74	0.892	174
1400	1.00	173	0.186	119	0.023	75	0.885	174
1500	0.995	171	0.247	113	0.028	72	0.881	173
1600	0.976	169	0.350	105	0.034	67	0.875	172
1700	0.952	166	0.585	92	0.043	57	0.856	170
1800	0.757	162	1.02	48	0.052	23	0.751	171
1900	0.682	176	1.02	5	0.038	-7	0.756	178
2000	0.825	-171	0.979	-43	0.019	-55	0.848	-178
2100	0.965	-177	0.526	-76	0.004	67	0.897	178
2200	0.994	180	0.355	-87	0.009	94	0.908	177

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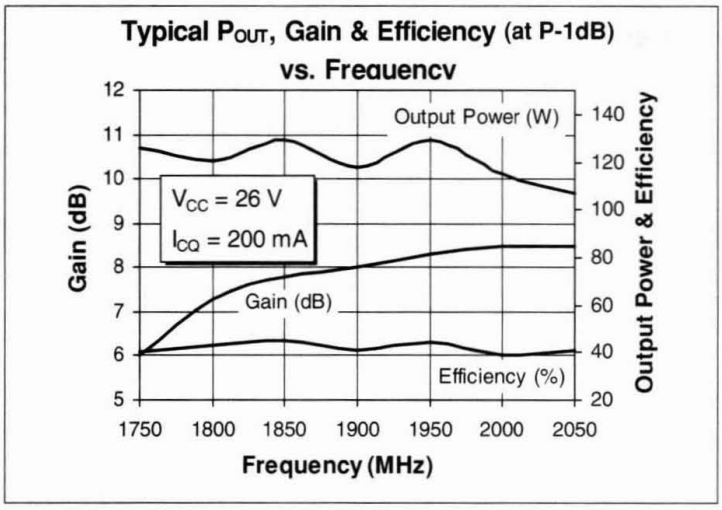
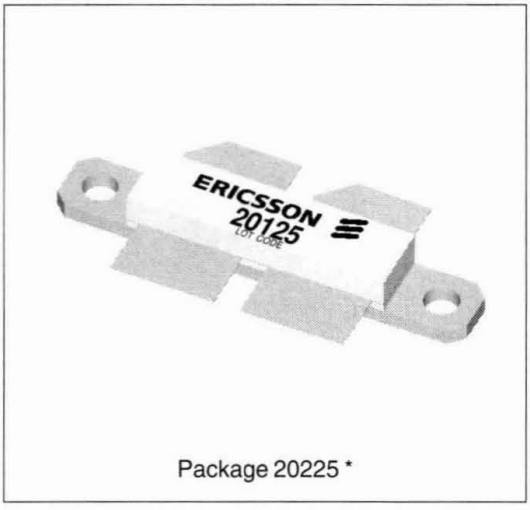
PTB 20125
100 Watts, 1.8–2.0 GHz
PCN/PCS Power Transistor

Description

The PTB 20125 is an NPN, push-pull RF power transistor intended for 26 Vdc class AB operation from 1.8 to 2.0 GHz. Rated at 100 watts PEP minimum output power, it is specifically intended for operation as a final stage in CDMA or TDMA systems. Ion implantation, nitride surface passivation and gold metallization ensure excellent device reliability. 100% lot traceability is standard.

- 100 Watts, 1.8–2.0 GHz
- Class AB Characteristics
- 40% Collector Efficiency at 100 Watts
- Gold Metallization
- Silicon Nitride Passivated





Package 20225 *

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage (1)	V_{CER}	55	Vdc
Collector-Base Voltage (1)	V_{CBO}	55	Vdc
Emitter-Base Voltage (collector open)	V_{EBO}	4.0	Vdc
Collector Current (continuous)	I_C	14	Adc
Total Device Dissipation at T_{flange} = 25°C Above 25°C derate by	P_D	400 2.3	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{flange} = 70°C)	$R_{\theta JC}$	0.44	°C/W

(1)per side

* This product not recommended or specified for CW or class A operation. Recommend two PTB 20175 for these applications.

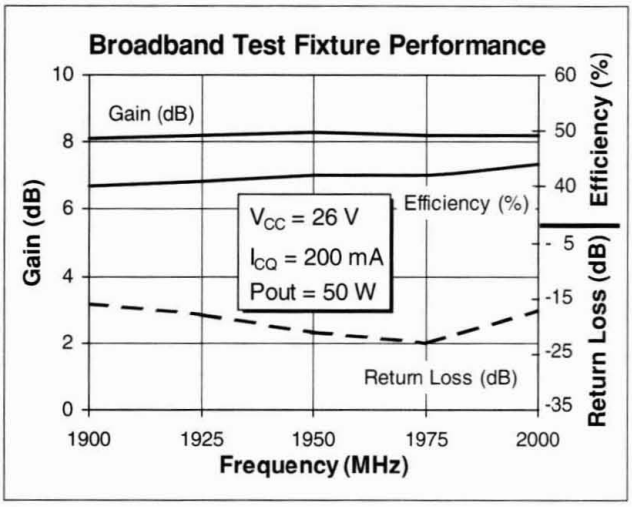
Electrical Characteristics (100% Tested—characteristics, conditions and limits shown per side)

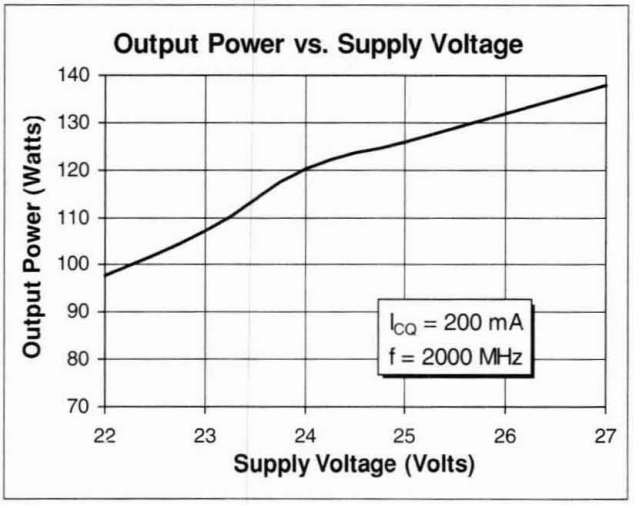
Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Breakdown Voltage C to E	V_{BE} = 0 V, I_C = 100 mA	$V_{(BR)CES}$	55	—	—	Volts
Breakdown Voltage E to B	I_C = 0 A, I_E = 20 mA	$V_{(BR)EBO}$	4.0	5.0	—	Volts
DC Current Gain	V_{CE} = 10 V, I_C = 1.5 A	h_{FE}	30	50	120	—

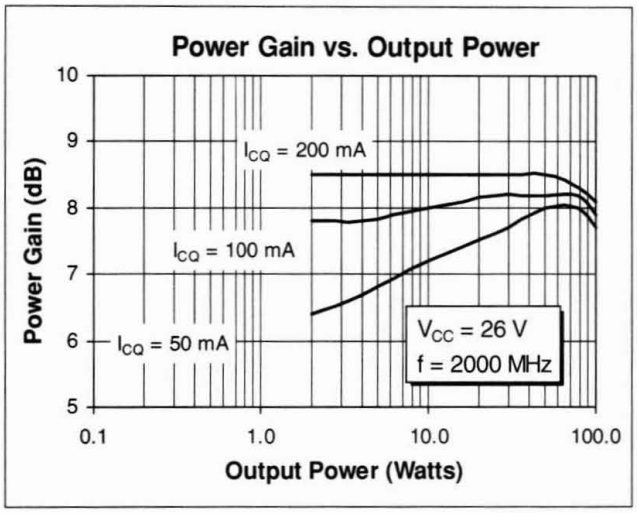
RF Specifications (100% Tested)

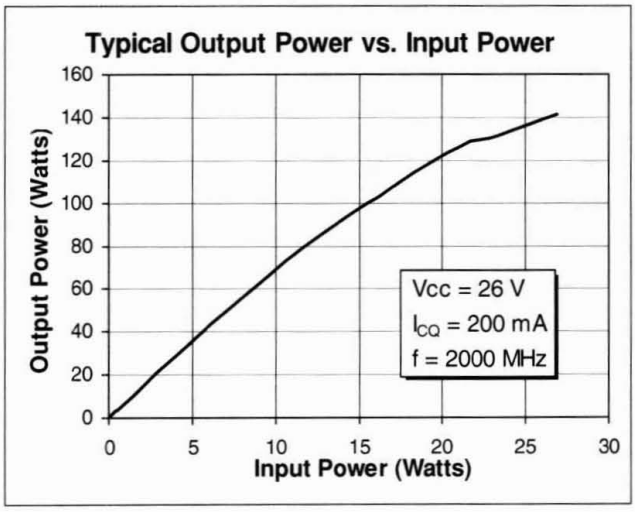
Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{CC} = 26 Vdc, P_{OUT} = 40 W(PEP), I_{CQ} = 2 x 100 mA, f = 2 GHz)	G_{pe}	7.0	8.0	—	dB
Collector Efficiency (V_{CC} = 26 Vdc, P_{OUT} = 100 W, I_{CQ} = 2 x 100 mA, f = 2 GHz)	η_C	40	45	—	%
Load Mismatch Tolerance (V_{CC} = 26 Vdc, P_{OUT} = 100 W(PEP), I_{CQ} = 2 x 100 mA, f = 2 GHz —at all phase angles)	Ψ	—	—	5:1	—

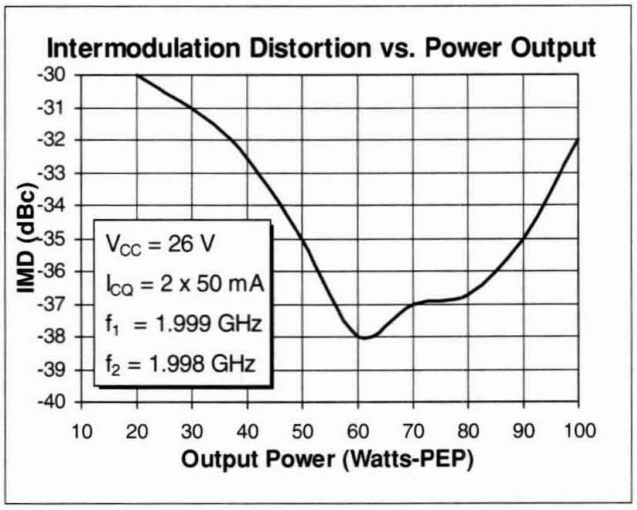
Typical Performance











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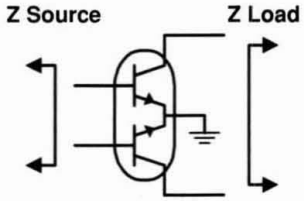
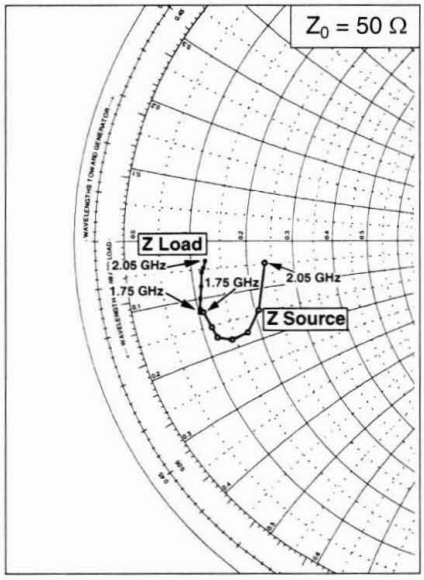
Impedance Data

(V_{CC} = 26 Vdc, P_{OUT} = 100 W, I_{CQ} = 2 x 100 mA)



Frequency	Z Source Ω		Z Load Ω	
GHz	R	jX	R	jX
1.75	5.4	-6.2	5.1	-6.2
1.80	5.8	-7.6	5.2	-5.8
1.85	6.0	-8.6	5.4	-5.0
1.90	7.2	-9.2	5.6	-4.0
1.95	8.8	-9.0	5.8	-2.8
2.00	10.4	-7.2	6.0	-2.4
2.05	11.8	-2.4	6.2	-1.8



PTB 20125

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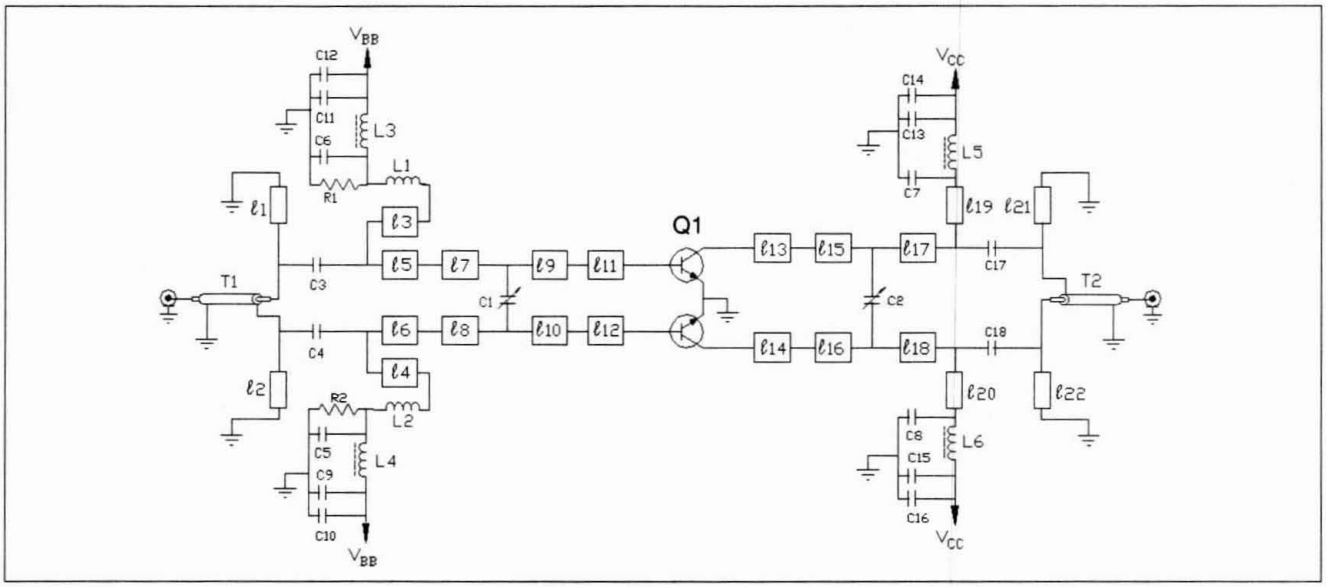
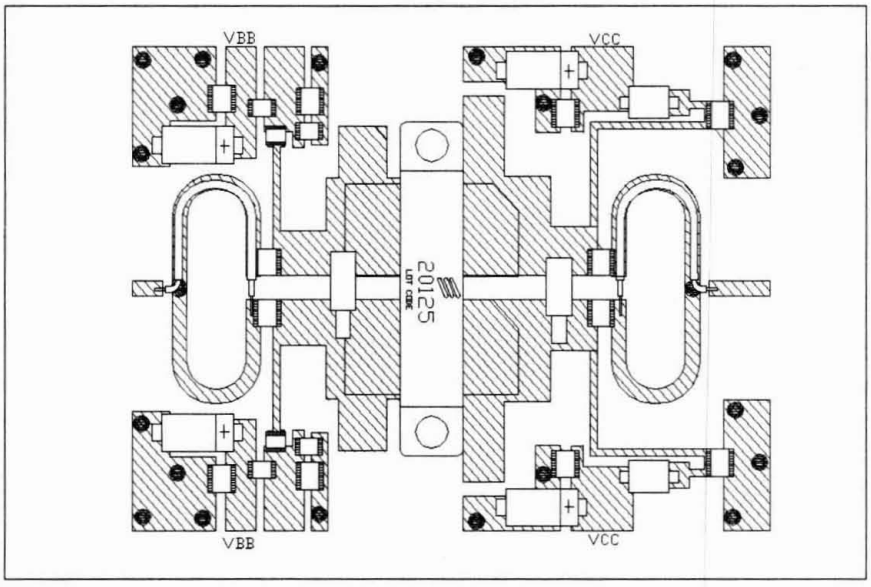
Test Circuit

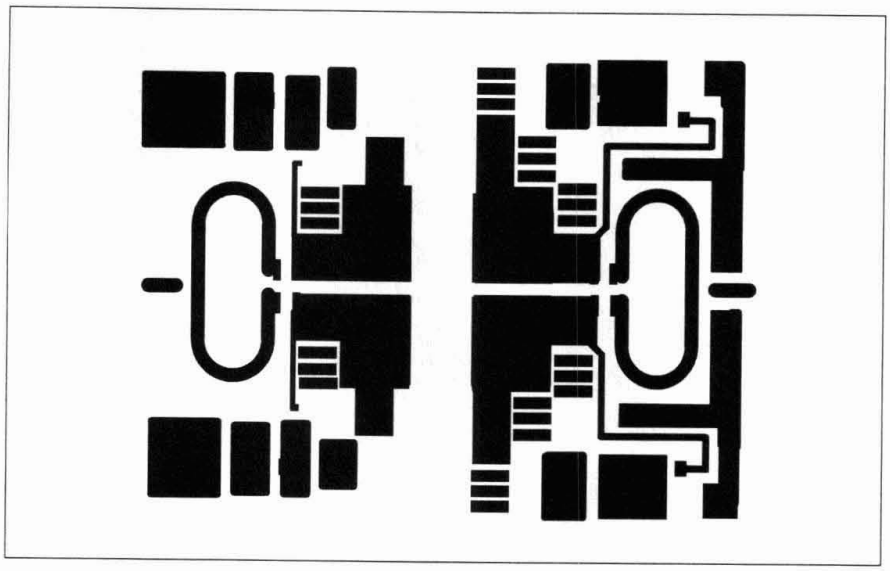


Block Diagram for f = 2 GHz

Q1	PTB 20125 NPN RF Transistor	L1, L2	6.8 nh SMT Inductor
ℓ1, ℓ2, ℓ21, ℓ22	.25λ 2GHz Microstrip 50 Ω	L3, L4	56 nh SMT Inductor
ℓ3, ℓ4	.085λ 2GHz Microstrip 80 Ω	L5, L6	4 mm. SMT Ferrite
ℓ5, ℓ6	.067λ 2GHz Microstrip 20 Ω	C1, C2	0–4 pF Johanson Piston Trimmer
ℓ7, ℓ8, ℓ11, ℓ12	.0217λ 2GHz Microstrip 11.7 Ω	C3-8, C17, C18	33 pF (B ATC 100)
ℓ9, ℓ10	.053λ 2GHz Microstrip 8.15 Ω	C9, C11, C13, C15	.1 μF 1206
ℓ13, ℓ14	.055λ 2GHz Microstrip 6.7 Ω	C10, C12, C14, C16	10 μF SMT Tantalum
ℓ15, ℓ16	.052λ 2GHz Microstrip 11.45 Ω	R1, R2	22 Ω SMT
ℓ17, ℓ18	.060λ 2GHz Microstrip 16.9 Ω	T1, T2	UT 70-50
ℓ19, ℓ20	.252λ 2GHz Microstrip 75 Ω	Circuit Board	.028" Dielectric Thickness, ε_r = 4.0, AlliedSignal, G200, 2 oz. copper



Placement Diagram (not to scale)



Artwork (1 inch ——— *)*

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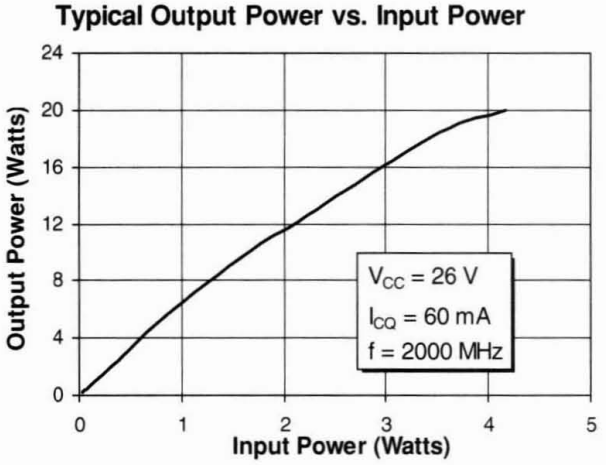
PRE-RELEASE PTB 20231*
18 Watts, 2.1–2.2 GHz
Cellular Radio RF Power Transistor

Description

The PTB 20231 is a class A/AB, NPN, common emitter RF power transistor intended for 26 Vdc operation from 2.1 to 2.2 GHz. Rated at 18 watts minimum output power in class AB and 8 watts minimum output power in class A, it may be used for both CW and PEP applications. Ion implantation, nitride surface passivation and gold metallization are used to ensure excellent device reliability. 100% lot traceability.©

- 18 Watts, 2.1–2.2 GHz
- Class A/AB Characteristics
- 40% Collector Efficiency at 18 Watts
- Full Gold Metallization
- Silicon Nitride Passivated



Package 20209

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CER}	55	Vdc
Collector-Base Voltage	V_{CBO}	55	Vdc
Emitter-Base Voltage (collector open)	V_{EBO}	4.0	Vdc
Collector Current (continuous)	I_C	2.8	Adc
Total Device Dissipation at T_{flange} = 25°C Above 25°C derate by	P_D	103 0.59	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{flange} = 70°C)	$R_{\theta JC}$	1.7	°C/W

* Note: Specifications for this product are preliminary and subject to change without notice. Please contact your sales representative for further product information. Complete product infromation is available on our Website at: www.ericsson.com/rfpower.

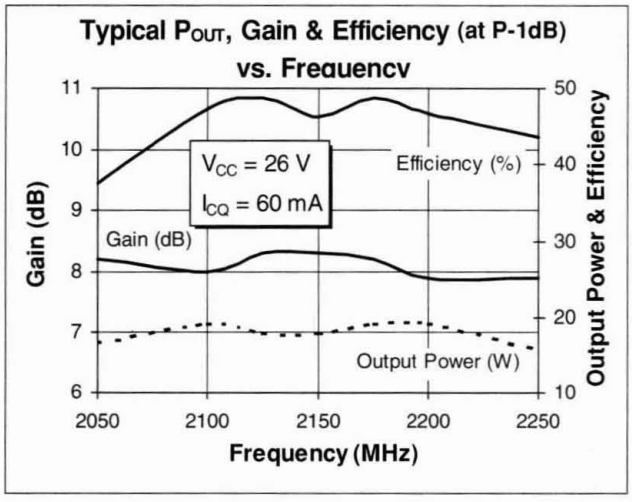
Electrical Characteristics (100% Tested)

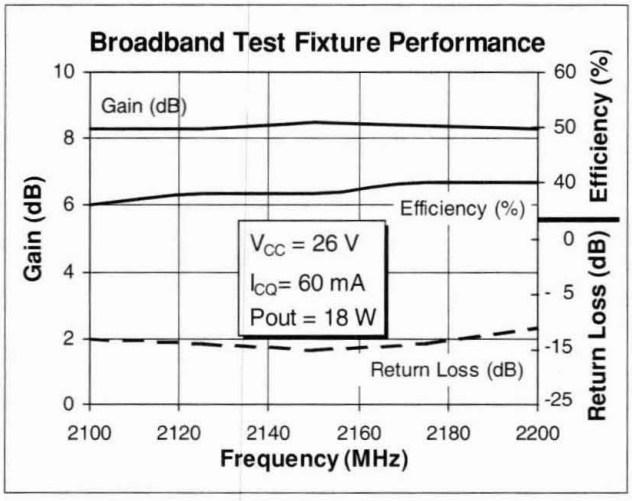
Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Breakdown Voltage C to E	V_{BE} = 0 V, I_C = 100 mA	$V_{(BR)CES}$	55	70	—	Volts
Breakdown Voltage C to E	I_B = 0 A, I_C = 5 mA, R_{BE} = 22 Ω	$V_{(BR)CER}$	55	—	—	Volts
Breakdown Voltage E to B	I_C = 0 A, I_E = 5 mA	$V_{(BR)EBO}$	3.5	5	—	Volts
DC Current Gain	V_{CE} = 5 V, I_C = 1.0 A	h_{FE}	20	50	100	—

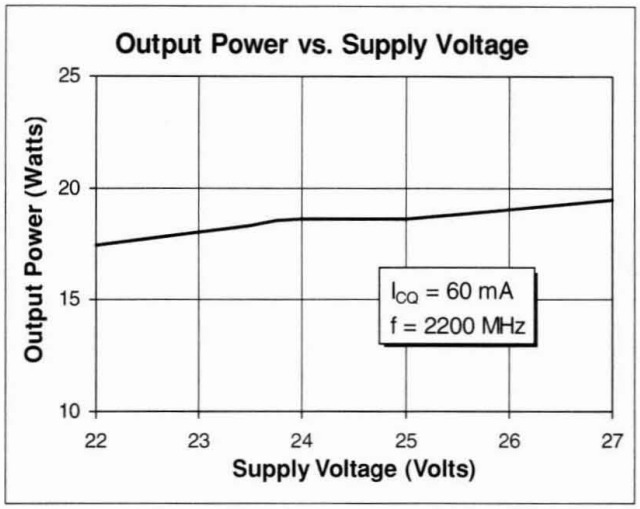
RF Specifications (100% Tested)

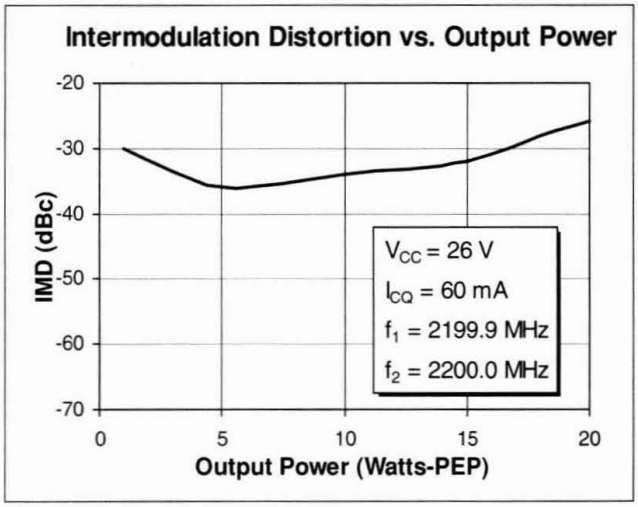
Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{CC} = 26 Vdc, P_{OUT} = 5 W, I_{CQ} = 130 mA, f = 2.2 GHz)	G_{pe}	8.0	8.5	—	dB
Power Output at 1 dB Compression (V_{CC} = 26 Vdc, I_{CQ} = 130 mA, f = 2.2 GHz)	P-1dB	18	—	—	Watts
Collector Efficiency (V_{CC} = 26 Vdc, P_{OUT} = 18 W, I_{CQ} = 130 mA, f = 2.2 GHz)	η_C	40	—	—	%
Load Mismatch Tolerance (V_{CC} = 26 Vdc, P_{OUT} = 9 W, I_{CQ} = 130 mA f = 2.2 GHz—all phase angles at frequency of test)	Ψ	—	—	5:1	—

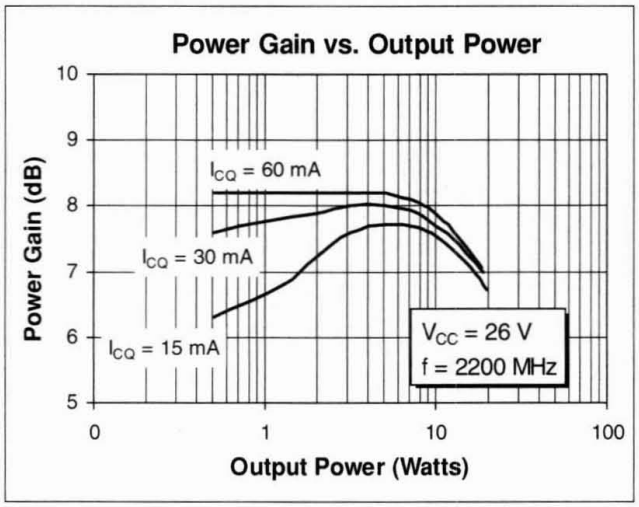
Typical Performance







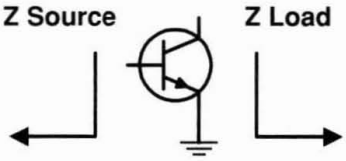




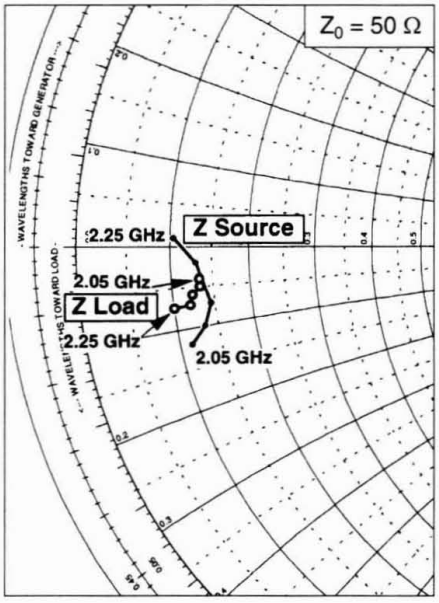
3

Impedance Data

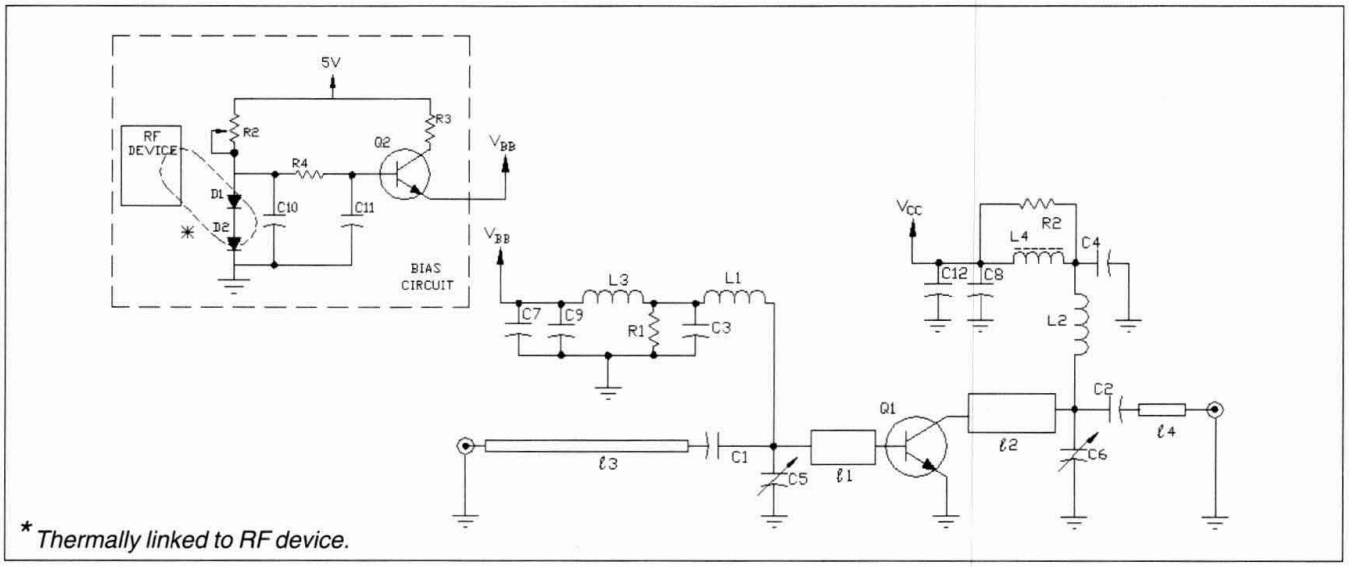
(V_{CC} = 26 Vdc, P_{OUT} = 18 W, I_{CQ} = 130 mA)



Frequency	Z Source Ω		Z Load Ω	
2.05	5.7	-6.0	6.7	-2.0
2.10	6.7	-5.0	6.7	-2.5
2.15	7.3	-3.6	6.2	-3.0
2.20	6.5	-1.0	6.0	-3.6
2.25	5.2	0.5	5.0	-3.7



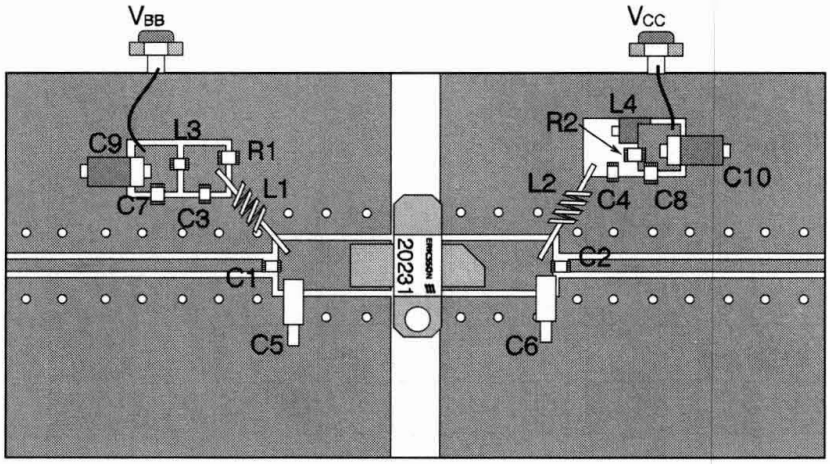
Test Circuit



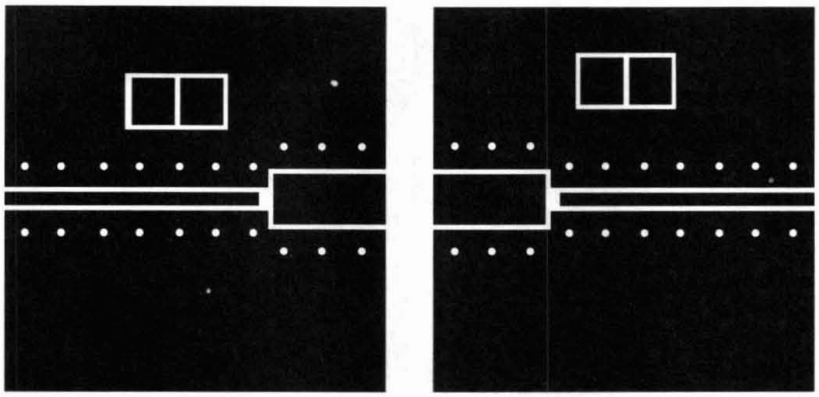
* *Thermally linked to RF device.*

Schematic for f = 2.2 GHz

Q1	PTB 20321, NPN RF Transistor	Circuit Board	.031 G-200, Solid Copper Bottom
$\ell 1$, $\ell 2$	0.198 λ 2.2GHz, Microstrip 18 Ω		
$\ell 3$, $\ell 4$	Microstrip 50 Ω		
L1, L2	4 Turn #20 AWG, .120" I.D.	*Bias Parts (not shown on layout)*	
L3	56 μA SMT Inductor	Q2	BCP 56 SMT NPN Transistor
L4	Ferrite Bead	D1	BAV 99 Diode
C1, C2, C3, C4	18 pF 100 ATC-A	C10, C11	0.1 μF SMT Capacitor
C5, C6	0-4 pF Johanson Variable Capacitor	R2	2K Potentiometer
C7, C8	0.1 υF, 1206	R3, R4	10 Ω 1206 SMT Resistor
C9, C10	10 pF Electrolytic Capacitor 35 V		



Board Assembly (not to scale)



Artwork (1 inch ——— *)*

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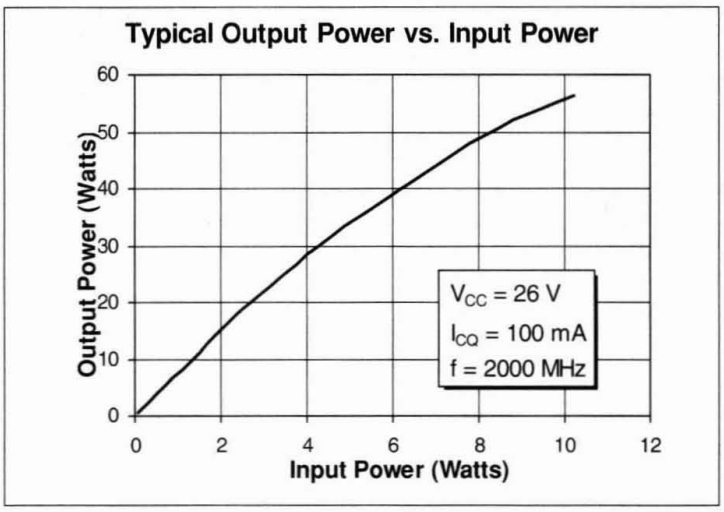
ERICSSON

PTB 20245
35 Watts, 2.1–2.2 GHz
Wide-Band CDMA Power Transistor

Description

The PTB 20245 is a class AB, NPN common emitter RF power transistor intended for 26 Vdc operation from 2.1 to 2.2 GHz frequency band. Rated at 35 watts minimum output power for PEP applications, it is specifically intended for operation as a final or driver stage in Wide CDMA or TDMA systems. Ion implantation, nitride surface passivation and gold metallization ensure excellent device reliability. 100% lot traceability is standard.

- 35 Watts, 2.1–2.2 GHz
- Class AB Characteristics
- Gold Metallization
- Silicon Nitride Passivated



Package 20223

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage	V_{CER}	55	Vdc
Collector-Base Voltage	V_{CBO}	55	Vdc
Emitter-Base Voltage (collector open)	V_{EBO}	3.5	Vdc
Collector Current (continuous)	I_C	7.7	Adc
Total Device Dissipation at T_{flange} = 25° C Above 25°C derate by	P_D	200 1.2	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{flange} = 70° C)	$R_{\theta JC}$	0.85	°C/W

Electrical Characteristics (100% Tested)

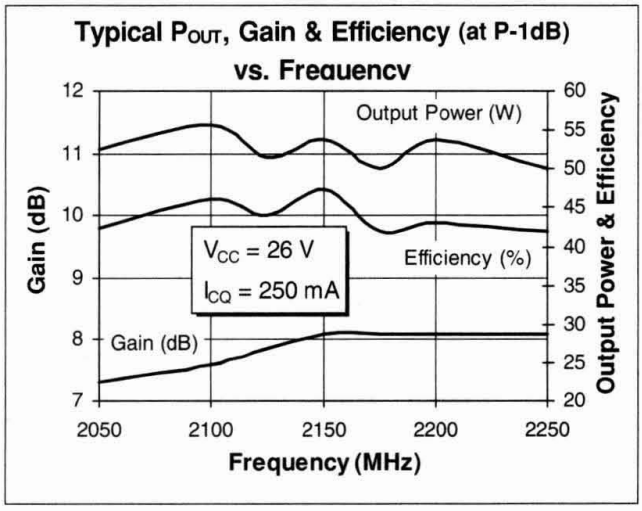
Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Breakdown Voltage C to E	V_{BE} = 0 V, I_C = 20 mA	$V_{(BR)CES}$	55	—	—	Volts
Breakdown Voltage C to E	I_B = 0 A, I_C = 20 mA, R_{BE} = 22 Ω	$V_{(BR)CER}$	55	—	—	Volts
Breakdown Voltage E to B	I_C = 0 A, I_E = 5 mA	$V_{(BR)EBO}$	3.5	4.0	—	Volts
DC Current Gain	V_{CE} = 10 V, I_C = 1.5 A	h_{FE}	30	40	—	—

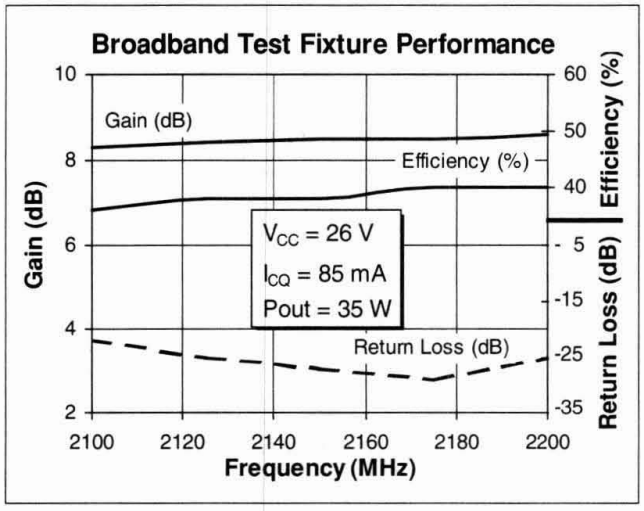
RF Specifications (100% Tested)

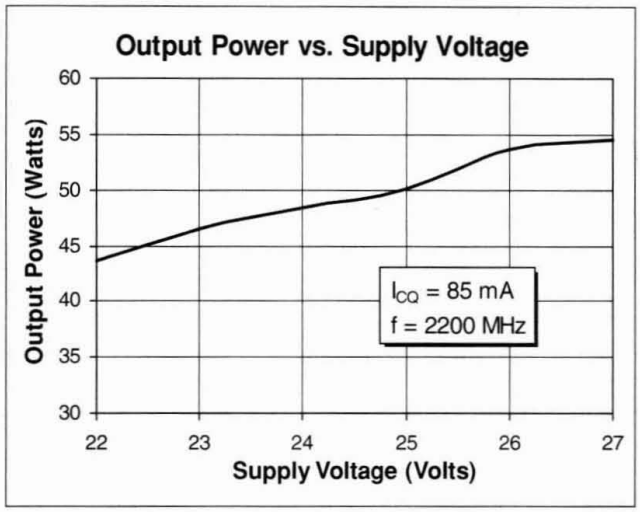
Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{CC} = 26 Vdc, P_{OUT} = 10 W, I_{CQ} = 85 mA, f = 2.2 GHz)	G_{pe}	7.5	8.5	—	dB
Power Output at 1 dB Compression (V_{CC} = 26 Vdc, I_{CQ} = 85 mA, f = 2.2 GHz)	P–1dB	35.0	—	—	Watts
Collector Efficiency (V_{CC} = 26 Vdc, P_{OUT} = 35 W, I_{CQ} = 85 mA, f = 2.2 GHz)	η_C	—	40	—	%
Load Mismatch Tolerance (V_{CC} = 26 Vdc, P_{OUT} = 17.5 W, I_{CQ} = 85 mA f = 2.2 GHz—all phase angles at frequency of test)	Ψ	—	—	5:1	—

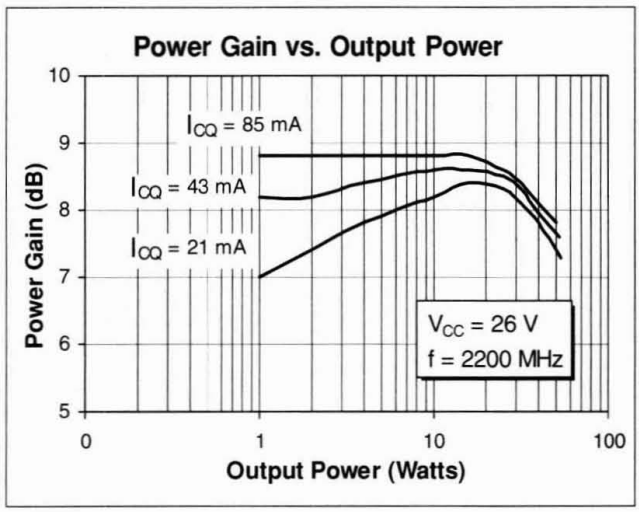
3

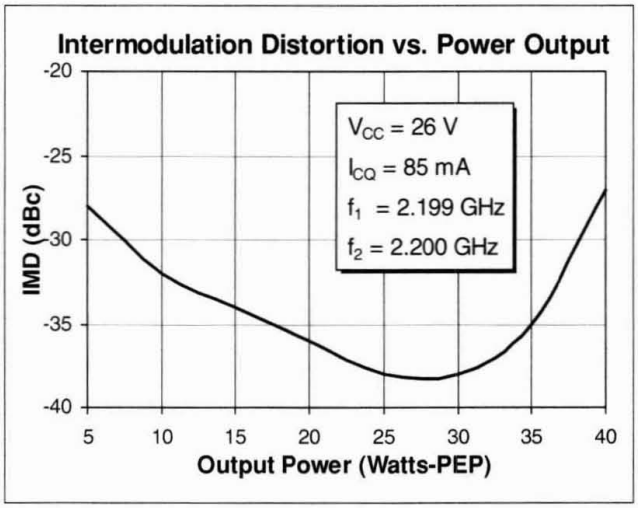
Typical Performance







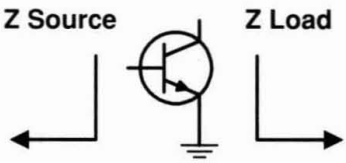




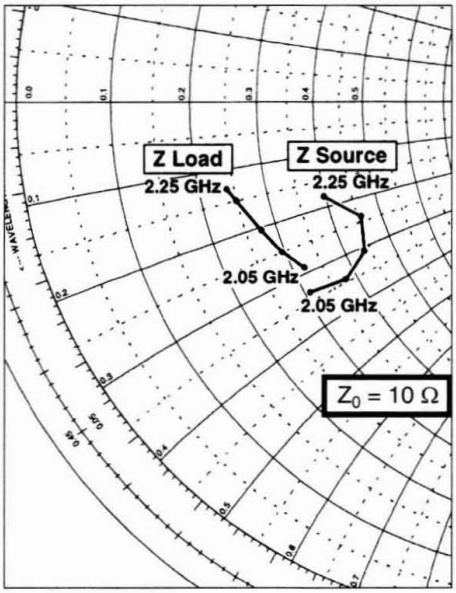
3

Impedance Data

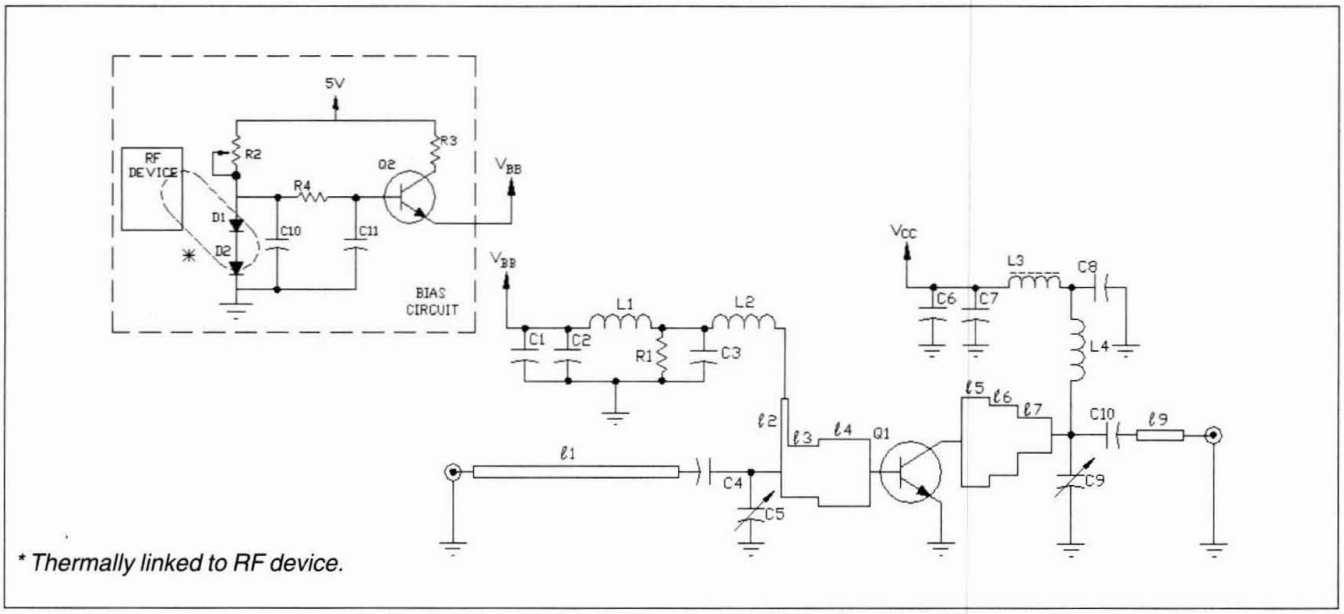
(V_{CC} = 26 Vdc, P_{OUT} = 35 W, I_{CQ} = 85 mA)



Frequency	Z Source Ω		Z Load Ω	
GHz	R	jX	R	jX
2.05	3.09	–3.35	3.20	–2.90
2.10	3.79	–3.45	2.95	–2.50
2.15	4.38	–3.10	2.75	–2.05
2.20	4.58	–2.40	2.50	–1.50
2.25	3.98	–1.80	2.40	–1.30



Test Circuit



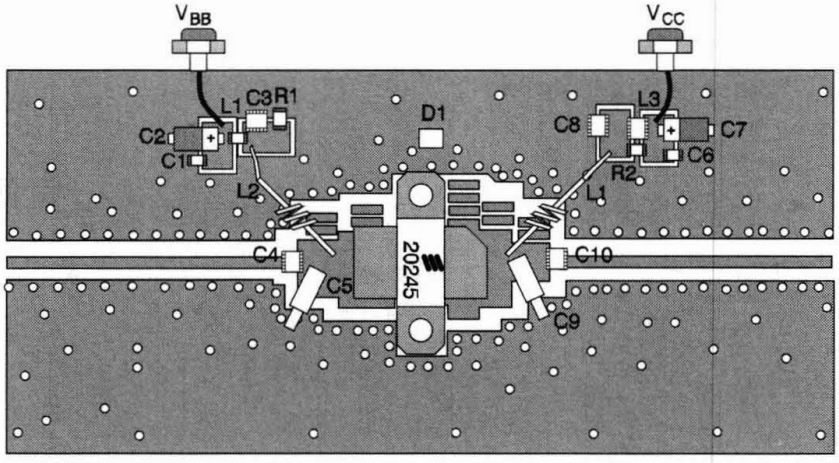
Schematic for f = 2.2 GHz

Q1	PTB 20245	NPN RF Transistor
ℓ1, ℓ9		Microstrip 50 Ω
ℓ2	.1 λ 2 GHz	Microstrip 75 Ω
ℓ3	.065 λ 2 GHz	Microstrip 16 Ω
ℓ4	.095 λ 2 GHz	Microstrip 12.5 Ω
ℓ5	.055 λ 2 GHz	Microstrip 9.7 Ω
ℓ6	.055 λ 2 GHz	Microstrip 12.5 Ω
ℓ7	.065 λ 2 GHz	Microstrip 22 Ω
C1, C6	0.1 µF	1206 Chip
C2, C7	10 µF, 35 V	SMT Tantalum
C3, C4, C8, C10	20 pF	ATC-100
C5, C9	0–4 pf	Johanson Trimmer

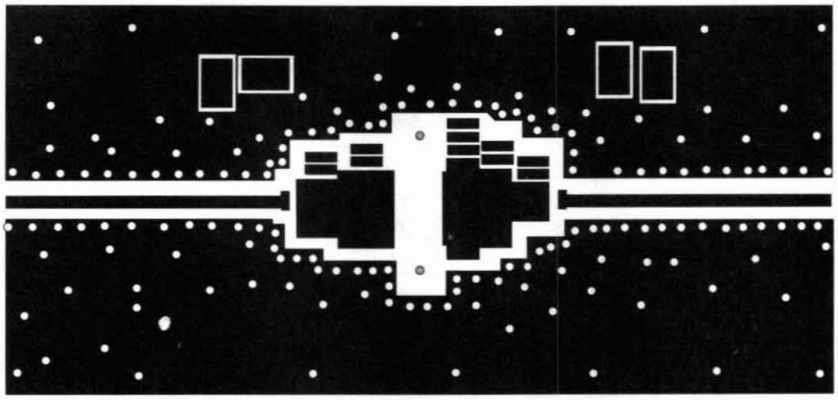
L1	56 nh	SMT Inductor
L2, L4	3 Turn #22, 0.25" O.D.	
L3	4 mm.	SMT Ferrite
R1	22 Ω	1206 SMT Resistor
Circuit Board	.028" Dielectric Thickness, ε_r = 4.0, AlliedSignal, G200, 2 oz. copper	

Bias Parts (not shown on layout)

Q2	BCP 56	SMT NPN Transistor
D1	BAV 99	Diode
C10, C11	0.1 pF	SMT Capacitor
R2	2K	Potentiometer
R3, R4	10 Ω	1206 SMT Resistor



Parts Layout (not to scale)



Artwork (1 inch ——— *)*

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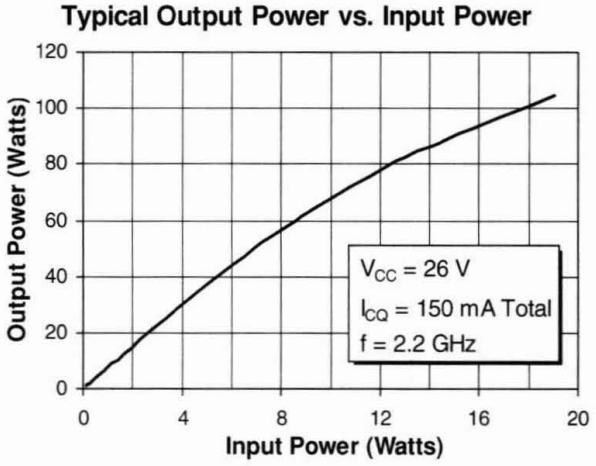
PTB 20235
70 Watts, 2.1–2.2 GHz
Wideband CDMA Power Transistor

Description

The PTB 20235 is a class AB, NPN, push-pull RF power transistor intended for 26 Vdc operation from 2.1 to 2.2 GHz. Rated at 70 watts PEP power output, it is specifically intended for operation as a final stage in Wide CDMA systems. Ion implantation, nitride surface passivation and gold metallization ensure excellent device reliability. 100% lot traceability.

- 70 Watts, 2.1–2.2 GHz
- Class AB Characteristics
- Full Gold Metallization
- Silicon Nitride Passivated



Package 20225 *

Maximum Ratings

Parameter	Symbol	Value	Unit
Collector-Emitter Voltage (1)	V_{CER}	55	Vdc
Collector-Base Voltage (1)	V_{CBO}	55	Vdc
Emitter-Base Voltage (collector open)	V_{EBO}	3.5	Vdc
Collector Current (continuous)	I_C	12	Adc
Total Device Dissipation at T_{flange} = 25°C Above 25°C derate by	P_D	320 1.83	Watts W/°C
Storage Temperature Range	T_{STG}	–40 to +150	°C
Thermal Resistance (T_{flange} = 70°C)	$R_{\theta JC}$	0.547	°C/W

(1) per side

* This package not recommended for class A or CW operation. Two PTB 20245s recommended for CW operation.

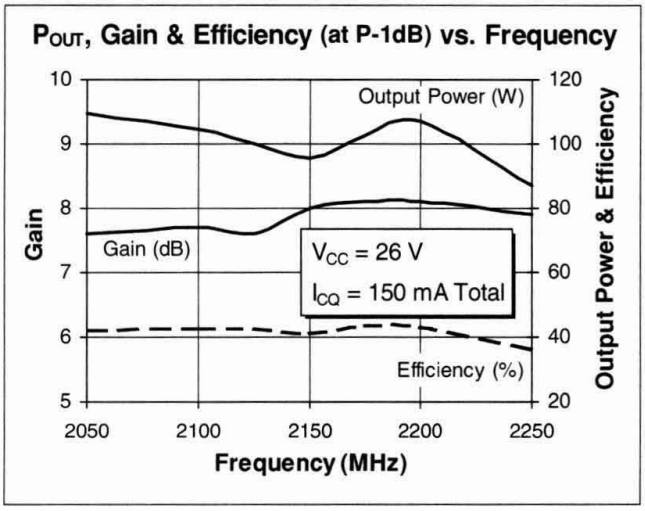
Electrical Characteristics (100% Tested—characteristics, conditions and limits shown per side)

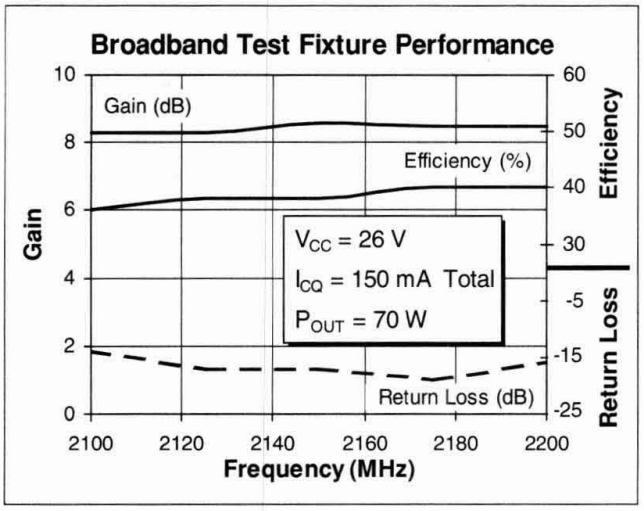
Characteristic	Conditions	Symbol	Min	Typ	Max	Units
Breakdown Voltage C to E	V_{BE} = 0 V, I_C = 20 mA	$V_{(BR)CES}$	55	—	—	Volts
Breakdown Voltage E to B	I_C = 0 A, I_E = 20 mA	$V_{(BR)EBO}$	3.5	4.0	—	Volts
DC Current Gain	V_{CE} = 10 V, I_C = 1.5 A	h_{FE}	30	50	120	—

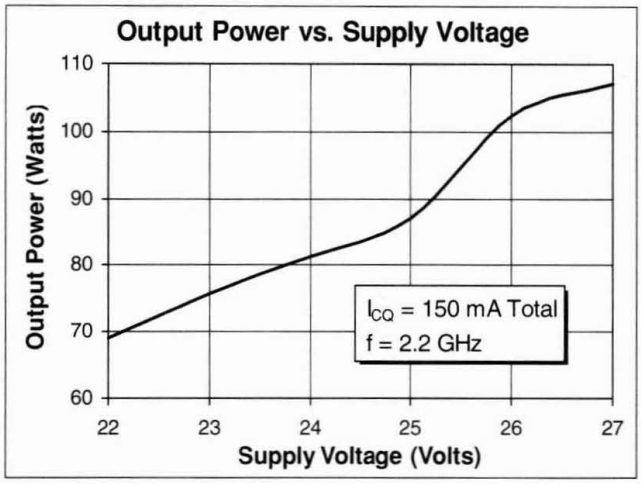
RF Specifications (100% Tested)

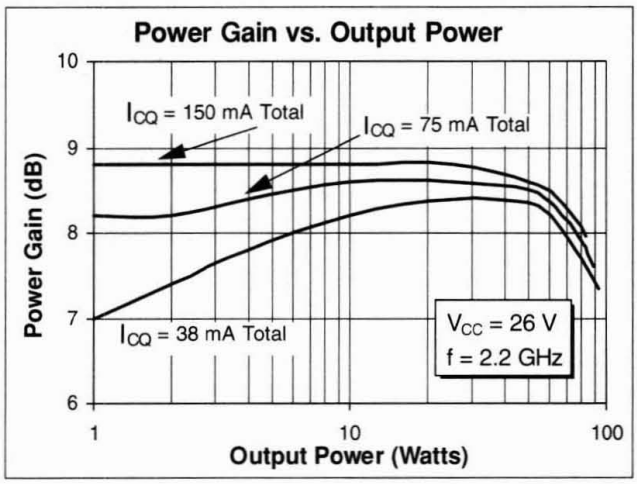
Characteristic	Symbol	Min	Typ	Max	Units
Gain (V_{CC} = 26 Vdc, P_{OUT} = 15 W, I_{CQ} = 150 mA, f = 2.2 GHz)	G_{pe}	7.5	8.0	—	dB
Gain Compression (V_{CC} = 26 Vdc, I_{CQ} = 150 mA, f = 2.2 GHz)	P-1dB	70	—	—	Watts
Collector Efficiency (V_{CC} = 26 Vdc, P_{OUT} = 70 W, I_{CQ} = 150 mA, f = 2.2 GHz)	η_C	—	40	—	%
Load Mismatch Tolerance (V_{CC} = 26 Vdc, P_{OUT} = 70 W(PEP), I_{CQ} = 150 mA, f = 2.2 GHz —at all phase angles)	Ψ	—	—	5:1	—

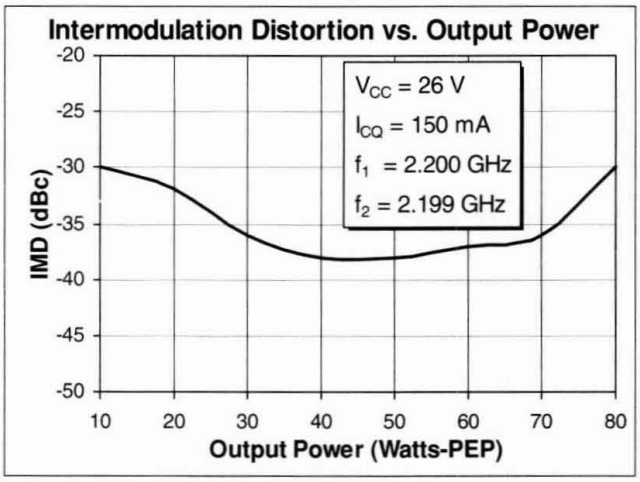
Typical Performance







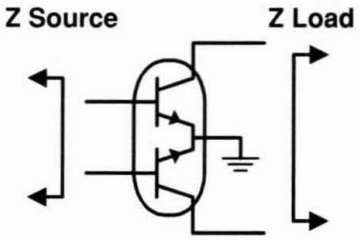




3

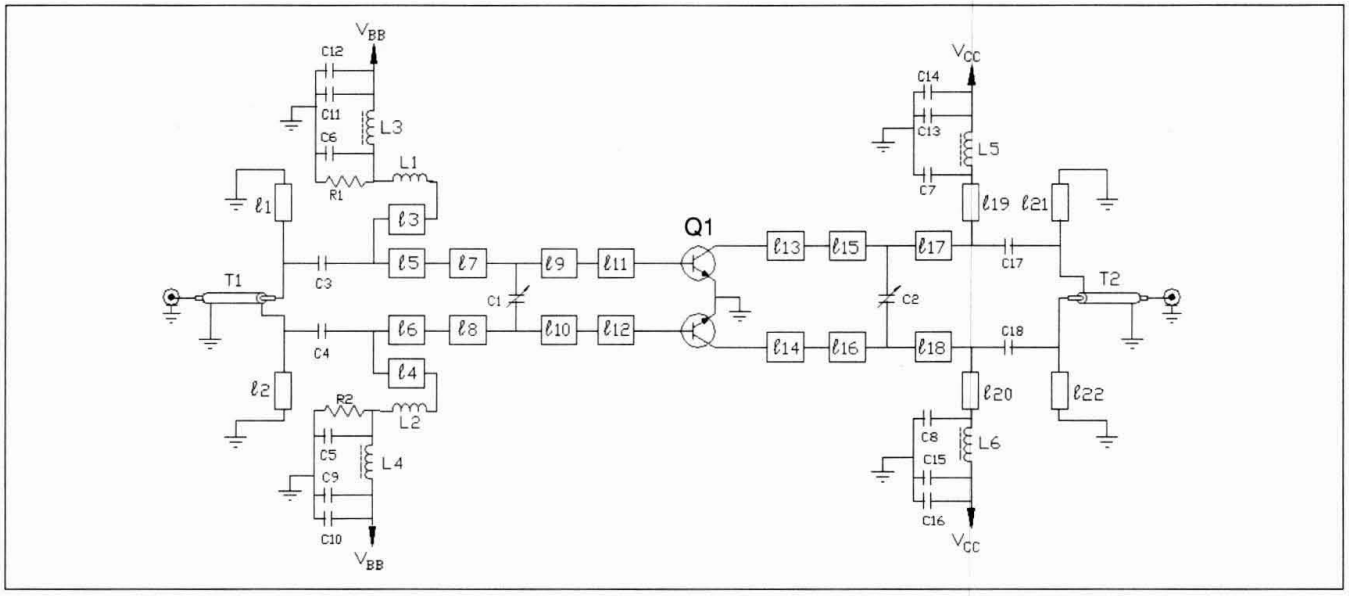
Impedance Data

V_{CC} = 26 Vdc, P_{OUT} = 70 W, I_{CQ} = 150 mA



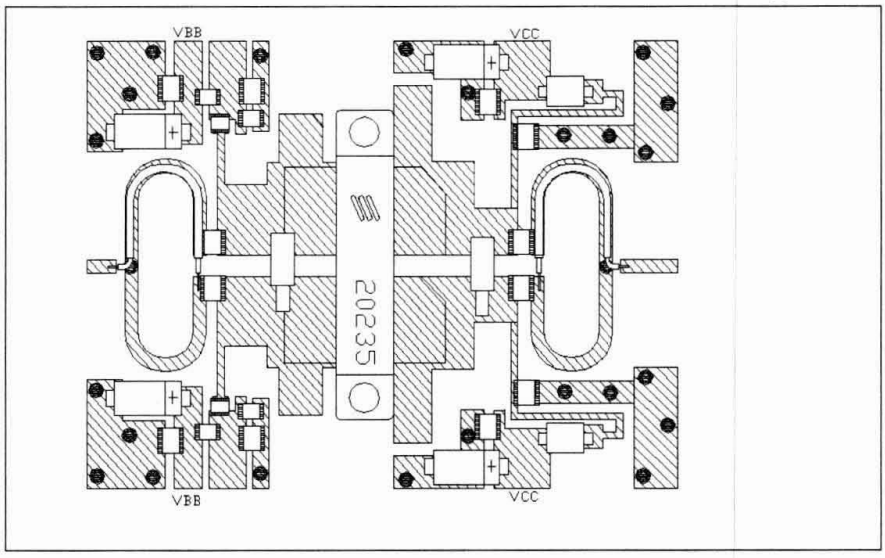
Frequency	Z Source Ω		Z Load Ω	
GHz	R	jX	R	jX
2.05	6.18	-6.7	6.4	-5.8
2.10	7.58	-6.9	5.9	-5.0
2.15	8.76	-6.2	5.5	-4.1
2.20	9.16	-4.8	5.0	-3.0
2.25	7.96	-3.6	4.8	-2.6

Test Circuit

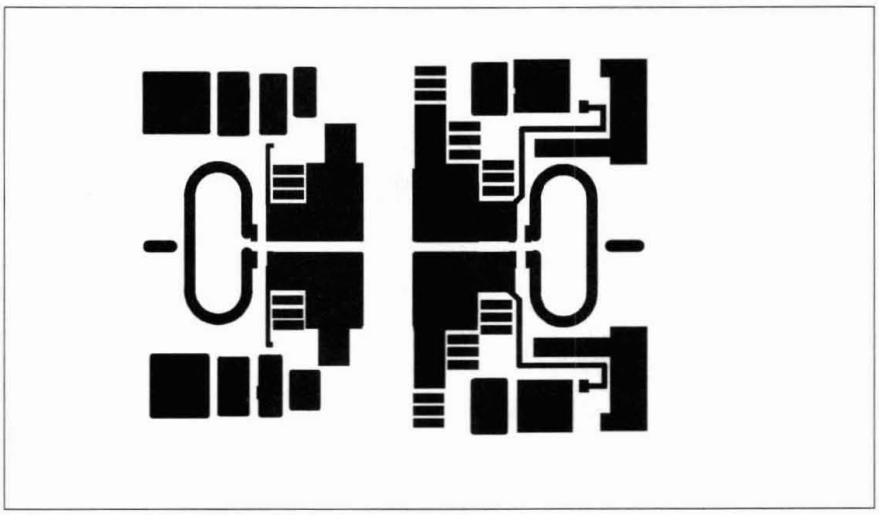


Block Diagram for f = 2 GHz

Q1	PTB 20235 NPN RF Transistor	L1, L2	6.8 nh SMT Inductor
ℓ1, ℓ2, ℓ21, ℓ22	0.25λ 2GHz Microstrip 50 Ω	L3, L4	56 nh SMT Inductor
ℓ3, ℓ4	0.085λ 2GHz Microstrip 80 Ω	L5, L6	4 mm. SMT Ferrite
ℓ5, ℓ6	0.067λ 2GHz Microstrip 20 Ω	C1, C2	0–4 pF Johanson Piston Trimmer
ℓ7, ℓ8, ℓ11, ℓ12	0.0217λ 2GHz Microstrip 11.7 Ω	C3-8, C17, C18	20 pF (B ATC 100)
ℓ9, ℓ10	0.053λ 2GHz Microstrip 8.15 Ω	C9, C11, C13, C15	0.1 µF 1206
ℓ13, ℓ14	0.055λ 2GHz Microstrip 6.7 Ω	C10, C12, C14, C16	10 µF SMT Tantalum
ℓ15, ℓ16	0.052λ 2GHz Microstrip 11.45 Ω	R1, R2	10 Ω SMT
ℓ17, ℓ18	0.060λ 2GHz Microstrip 16.9 Ω	T1, T2	UT 70-50
ℓ19, ℓ20	0.160λ 2GHz Microstrip 75 Ω	Circuit Board	.028" Dielectric Thickness, ε_r = 4.0, AlliedSignal, G200, 2 oz. copper



Placement Diagram (not to scale)



Artwork (1 inch ——— *)*

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PTH 31001 ..... **471**

PTH 31042 ..... **475**

PTH 31002 ..... **479**

Dual-Stage Hybrids

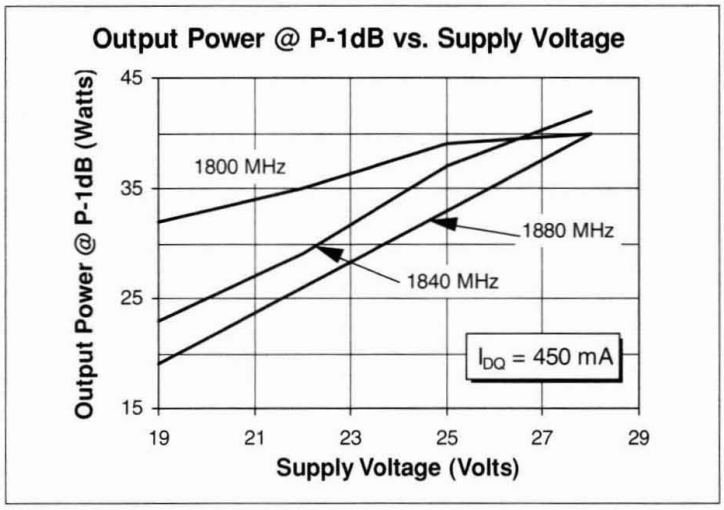
PTH 32003 ..... **483**

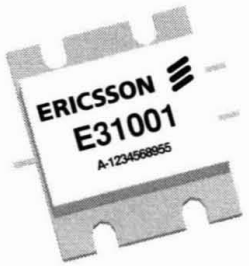
PRE-RELEASE PTH 31001*
35 Watts, 1800–1900 MHz
50-Ohm Power Hybrid

Description

The PTH 31001 is a 50 ohm power hybrid intended for applications requiring linear power amplification in the PCS frequency range. The part is designed to operate with 50 ohm source and load impedances and includes bias circuitry with temperature compensation. The design is intended to simplify system design and save space with an overall size of less than one square inch. 100% lot traceability is standard.

- Guaranteed Performance at 1900 MHz, 28 V
  - Output Power = 35 Watts (P-1dB)
  - Power Gain = 12 dB Typ
  - Efficiency = 40%
- Rugged Hybrid Design
- Input Decoupling
- High Single Stage Gain
- Excellent Linearity
- Input VSWR less than 1:5:1
- Gold Metallization





Package A

Performance Characteristics

Parameter	Symbol	Min	Typ	Max	Units
Frequency Range V_{DD} (Nom.) = 28, I_{DQ} (Nom., Adjustable) = 475 mA	f	1800	—	1900	MHz
Power Gain V_{DD} (Nom.) = 28, I_{DQ} (Nom., Adjustable) = 475 mA	G_p	11	12	—	dB
Output Power at 1 dB Compressed V_{DD} (Nom.) = 28, I_{DQ} (Nom., Adjustable) = 475 mA	P-1dB	35	40	—	W
Input VSWR V_{DD} (Nom.) = 28, I_{DQ} (Nom., Adjustable) = 475 mA	ψ	1.3:1	—	1.6:1	—
Efficiency at P-1dB V_{DD} (Nom.) = 28, I_{DQ} (Nom., Adjustable) = 475 mA	η	35	40	—	%

* Note: Specifications for this product are preliminary and subject to change without notice. Please contact your sales representative for further product information. Complete product infromation is available on our Website at: www.ericsson.com/rfpower.

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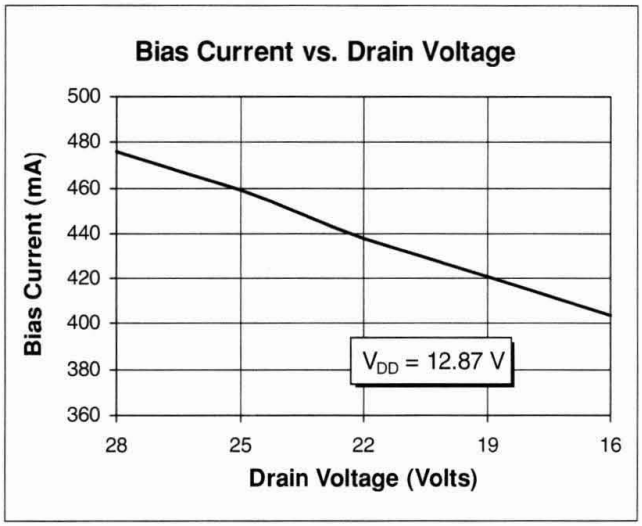
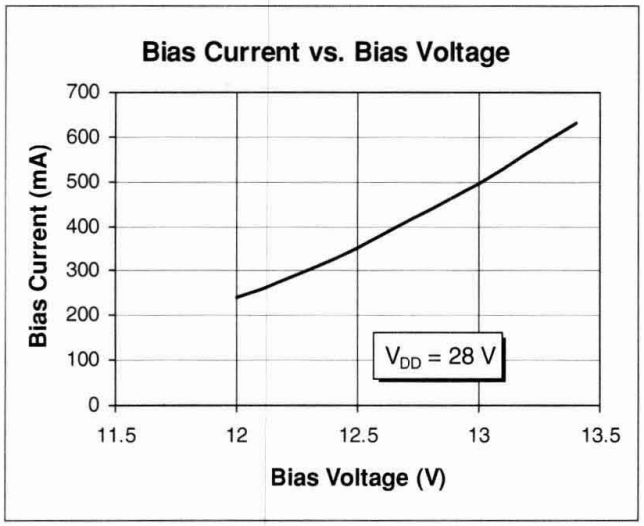
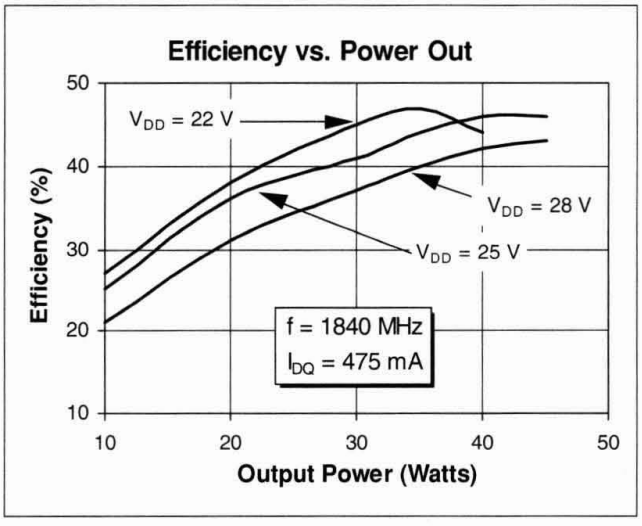
Maximum Ratings

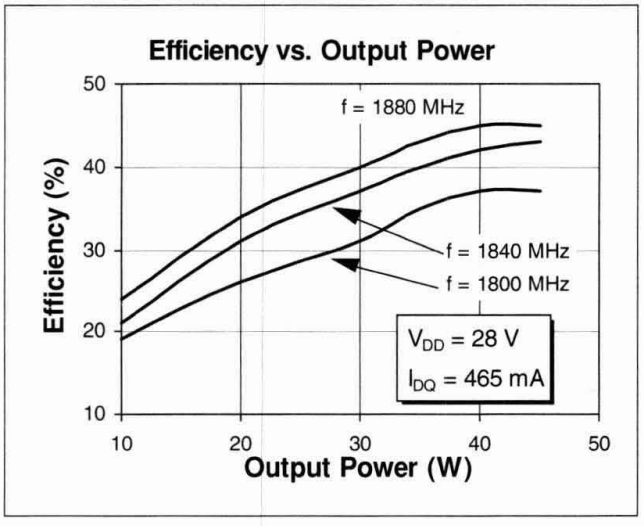
Parameter	Symbol	Value	Unit
Supply Voltage	V_{DD}	32	Vdc
Bias Current	I_{DQ}	1000	mA
Operating Temperature	T_{flange}	90	°C
Total Device Dissipation at T_{flange} = 25°C Above 25°C derate by	P_D	TBD	Watts W/°C
Storage Temperature	T_{STG}	125	°C

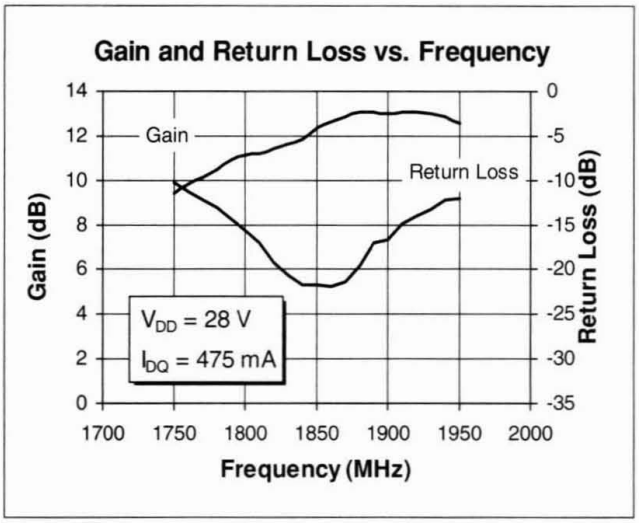
Typical Performance

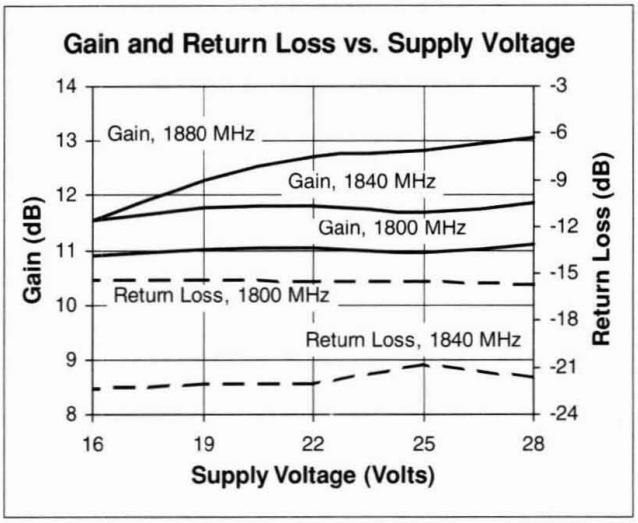


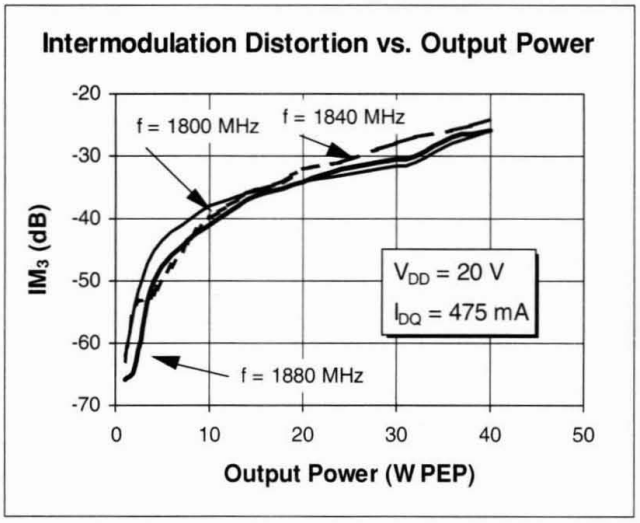


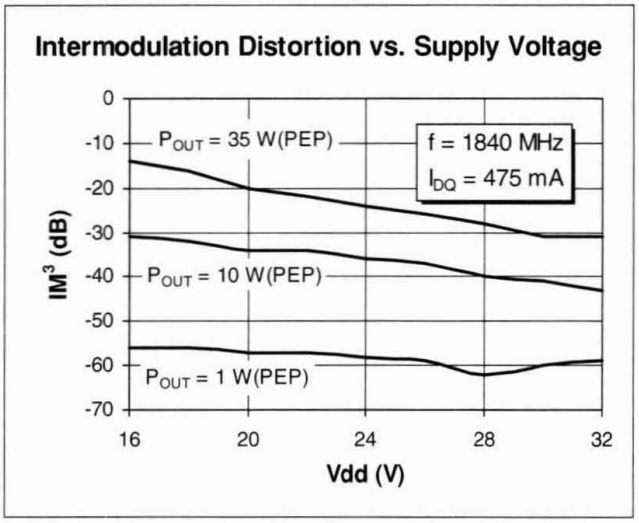












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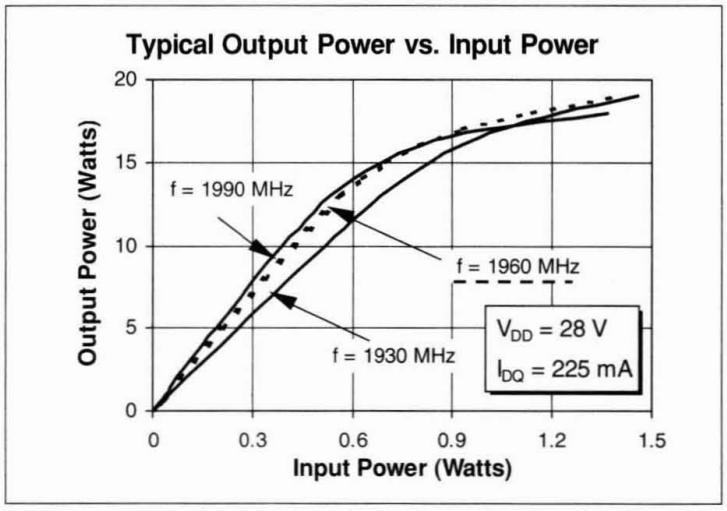
LF
1301-PTH 31001 Uen Rev A 1998-08-05

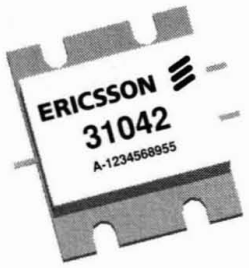
PTH 31042
10 Watts, 1900–2000 MHz
50-Ohm Power Hybrid

Description

The PTH 31042 is a 50–ohm power hybrid intended for applications requiring linear power amplification in the PCS frequency range. The part is designed to operate with 50–ohm source and load impedances and includes bias circuitry with temperature compensation. The design is intended to simplify system design and save space with an overall size of less than one square inch.

- **Guaranteed Performance at 1930 to 1990 MHz, 28 V**
  - **Output Power = 12 Watts (P-1dB) Min**
  - **Power Gain = 11 dB Min**
  - **Efficiency = 40% Min @ P-1dB**
- **Rugged Hybrid Design**
- **High Single Stage Gain**
- **Excellent Linearity**
- **Input VSWR less than 1:5:1**
- **Full Gold Metallization**
- **100% Lot Traceability**





Package A

Performance Characteristics

Parameter	Symbol	Min	Typ	Max	Units
Frequency Range V_{DD} (Nom.) = 28, I_{DQ} (Nominal) = 225 mA	f	1930	—	1990	MHz
Power Gain V_{DD} (Nom.) = 28, I_{DQ} (Nominal) = 225 mA	G_p	11	12.5	—	dB
Output Power at 1 dB Compressed V_{DD} (Nom.) = 28, I_{DQ} (Nominal) = 225 mA	P-1dB	12	16	—	W
Input Return Loss V_{DD} (Nom.) = 28, I_{DQ} (Nominal) = 225 mA	RL	14	19	—	dB
Efficiency at P-1dB V_{DD} (Nom.) = 28, I_{DQ} (Nominal) = 225 mA	η	40	48	—	%

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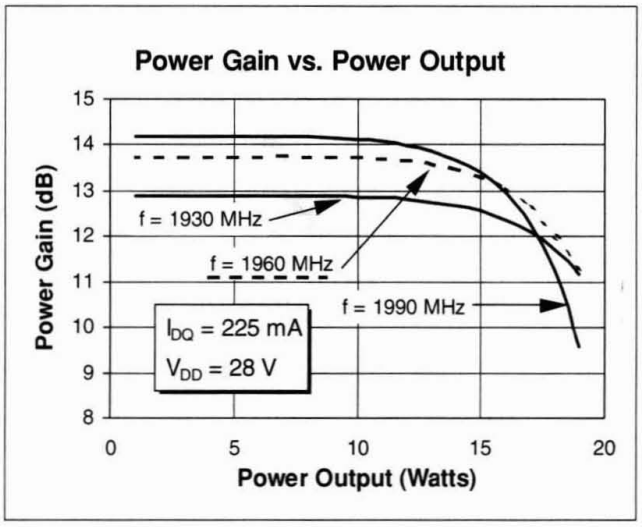
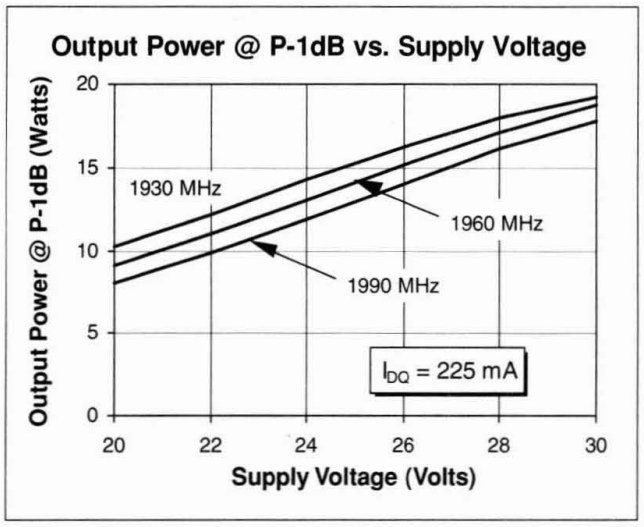
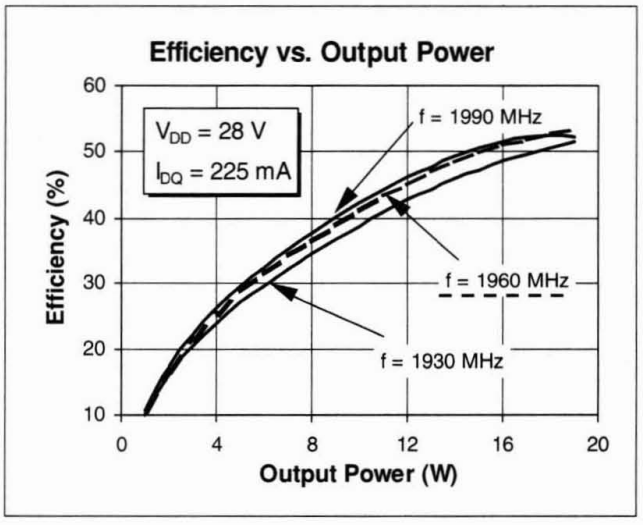
Maximum Ratings

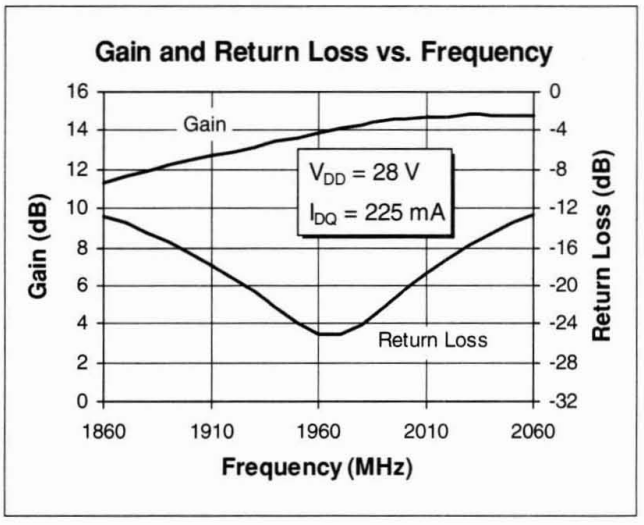
Parameter	Symbol	Value	Unit
Supply Voltage	V_{DD}	32	Vdc
Bias Current	I_{DQ}	1000	mA
Operating Temperature	T_{CASE}	90	°C
Total Device Dissipation at T_{CASE} = 25°C Above 25°C derate by	P_D	TBD	Watts W/°C
Storage Temperature	T_{STG}	125	°C

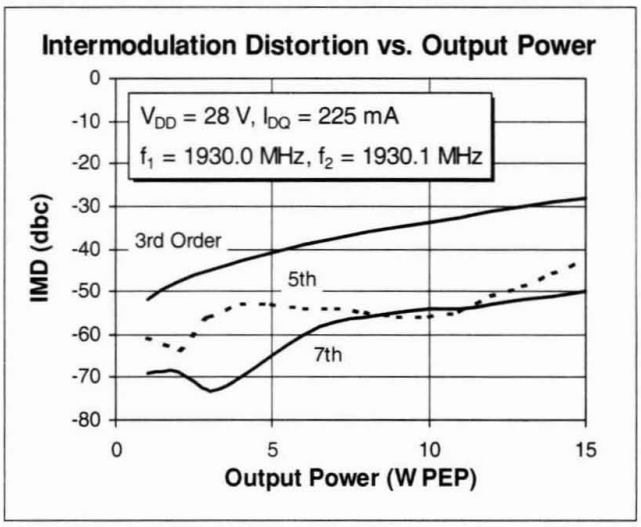
Typical Performance

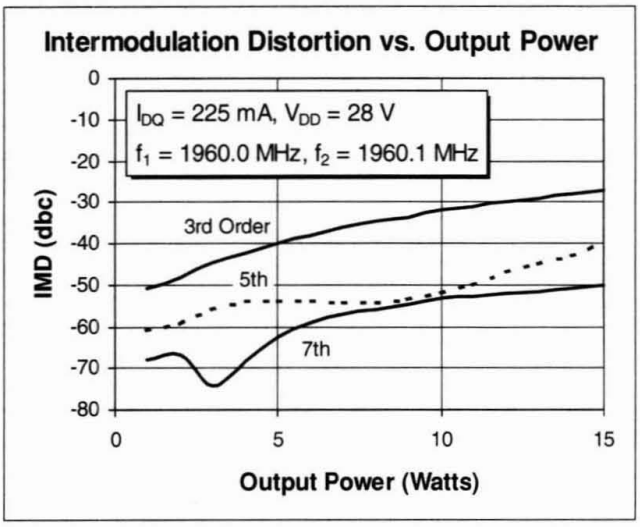


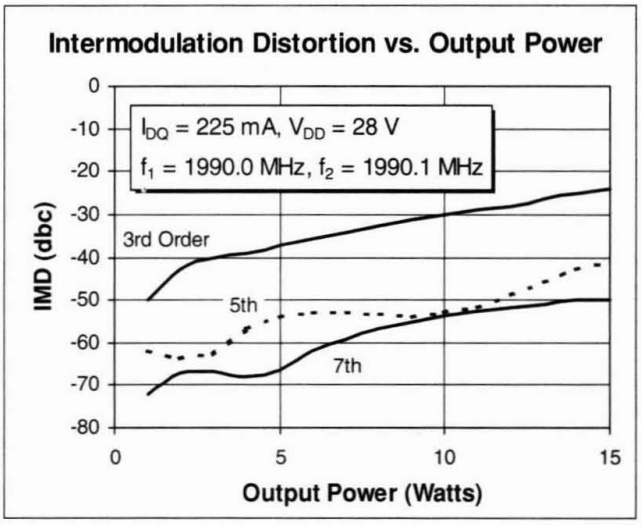


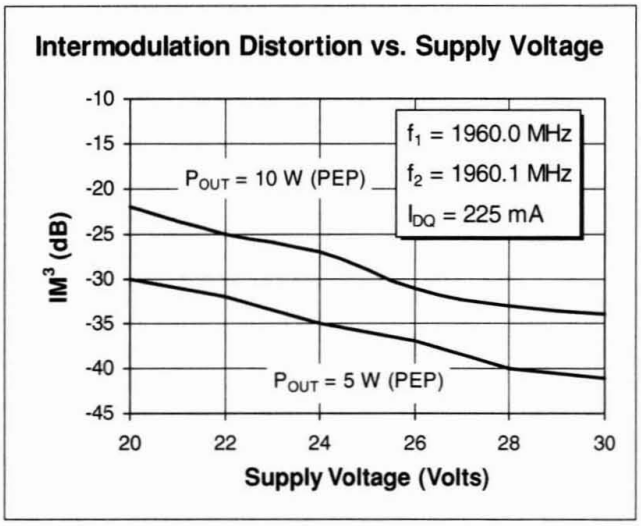


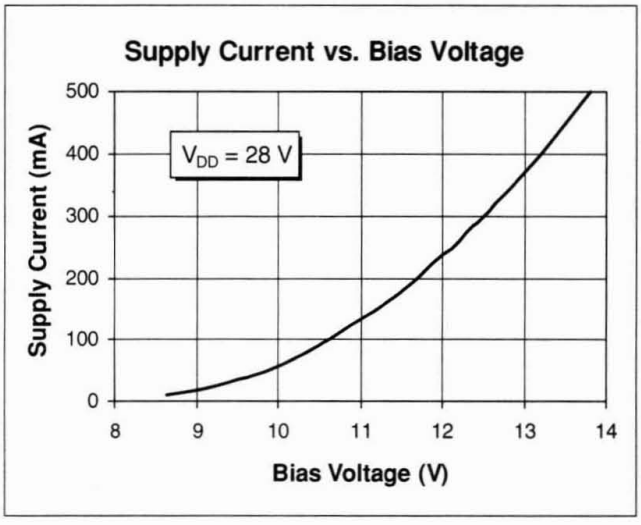


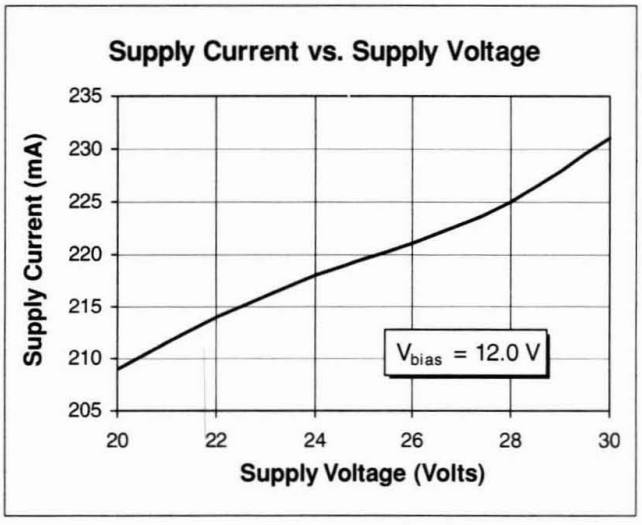

Intermodulation Distortion vs. Output Power
V_{DD} = 28 V, I_{DQ} = 225 mA
f_1 = 1930.0 MHz, f_2 = 1930.1 MHz
3rd Order
5th
7th
IMD (dbc)
0
-10
-20
-30
-40
-50
-60
-70
-80
0
5
10
15
Output Power (W PEP)


Intermodulation Distortion vs. Output Power
I_{DQ} = 225 mA, V_{DD} = 28 V
f_1 = 1960.0 MHz, f_2 = 1960.1 MHz
3rd Order
5th
7th
IMD (dbc)
0
-10
-20
-30
-40
-50
-60
-70
-80
0
5
10
15
Output Power (Watts)

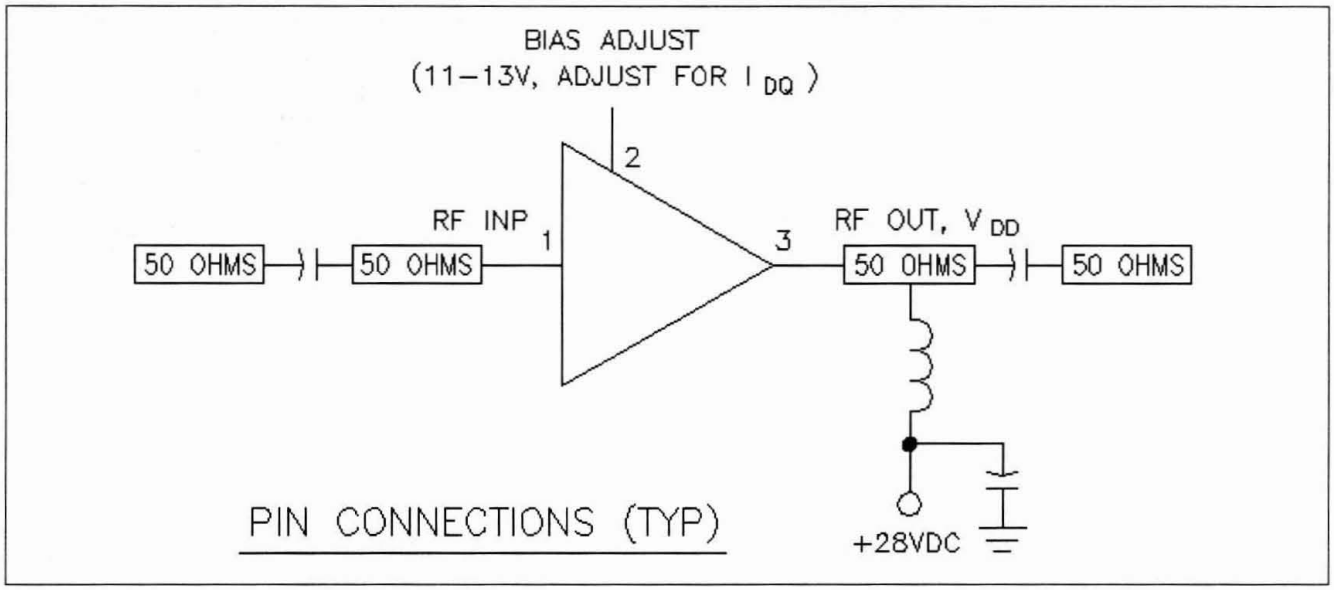

Intermodulation Distortion vs. Output Power
I_{DQ} = 225 mA, V_{DD} = 28 V
f_1 = 1990.0 MHz, f_2 = 1990.1 MHz
3rd Order
5th
7th
IMD (dbc)
0
-10
-20
-30
-40
-50
-60
-70
-80
0
5
10
15
Output Power (Watts)


Intermodulation Distortion vs. Supply Voltage
f_1 = 1960.0 MHz
f_2 = 1960.1 MHz
I_{DQ} = 225 mA
P_{OUT} = 10 W (PEP)
P_{OUT} = 5 W (PEP)
IM^3 (dB)
-10
-15
-20
-25
-30
-35
-40
-45
20
22
24
26
28
30
Supply Voltage (Volts)


Supply Current vs. Bias Voltage
V_{DD} = 28 V
Supply Current (mA)
500
400
300
200
100
0
8
9
10
11
12
13
14
Bias Voltage (V)


Supply Current vs. Supply Voltage
V_{bias} = 12.0 V
Supply Current (mA)
235
230
225
220
215
210
205
20
22
24
26
28
30
Supply Voltage (Volts)

Schematic



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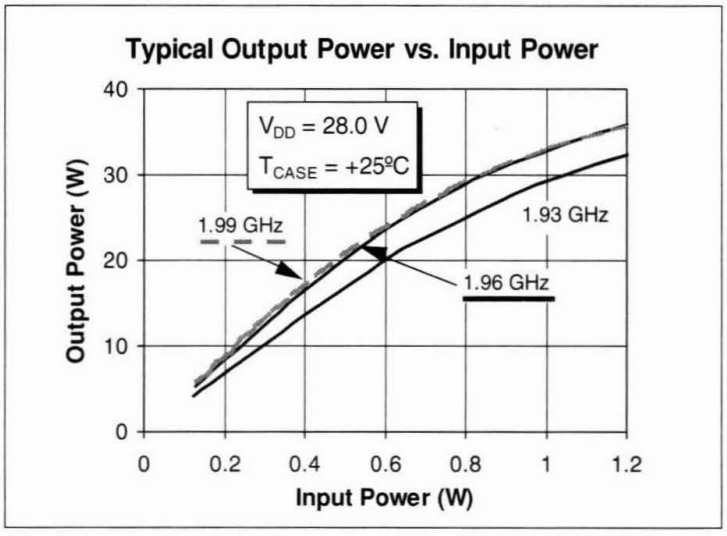
PTH 31002
30 Watts, 1.9–2.0 GHz
50-Ohm Power Hybrid

Description

The PTH 31002 is a 50–ohm power hybrid intended for applications requiring linear power amplification in the PCS frequency range. The part is designed to operate with 50–ohm source and load impedances and includes bias circuitry with temperature compensation. The design is intended to simplify system design and save space with an overall size of less than one square inch.

- **Guaranteed Performance at 1.93 to 1.99 GHz, 28 V**
  - **Output Power = 30 Watts (P-1dB) Min**
  - **Power Gain = 12 dB Min**
  - **Efficiency = 30% Min @ P-1dB**
- **Rugged Hybrid Design**
- **High Single Stage Gain**
- **Excellent Linearity**
- **Input VSWR less than 1.5:1**
- **Full Gold Metallization**
- **100% Lot Traceability**



Package A

Performance Characteristics

Parameter V_{DD} = 28.0 V, I_{DQ} (Typical) = 550 mA	**Symbol**	**Min**	**Typ**	**Max**	**Units**
Frequency Range	f	1930	—	1990	MHz
Power Gain	G_p	12	14	—	dB
Output Power at 1 dB Compressed	P-1dB	30	34	—	W
Input VSWR	ψ	—	1.25:1	1.5:1	—
Efficiency at P-1dB	η	30	35	—	%

All published data at T_{CASE} = 25°C unless otherwise indicated.

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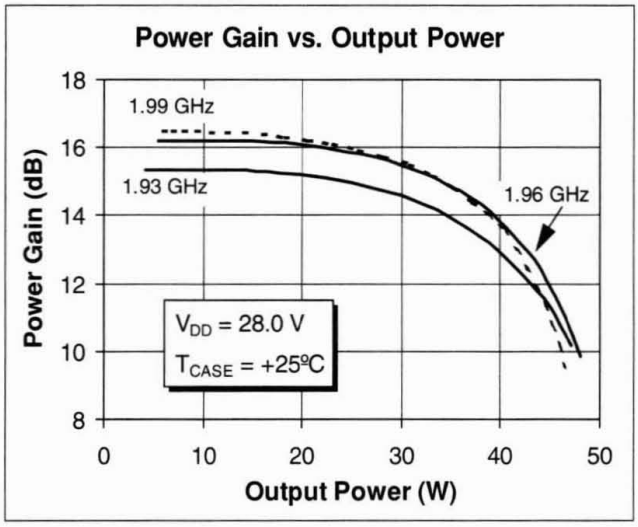
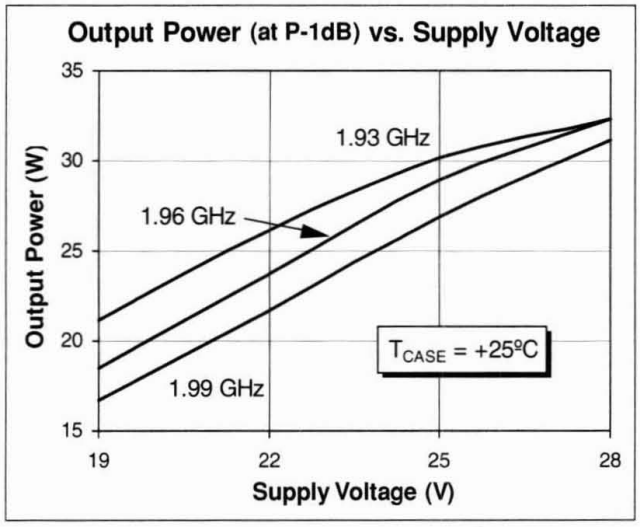
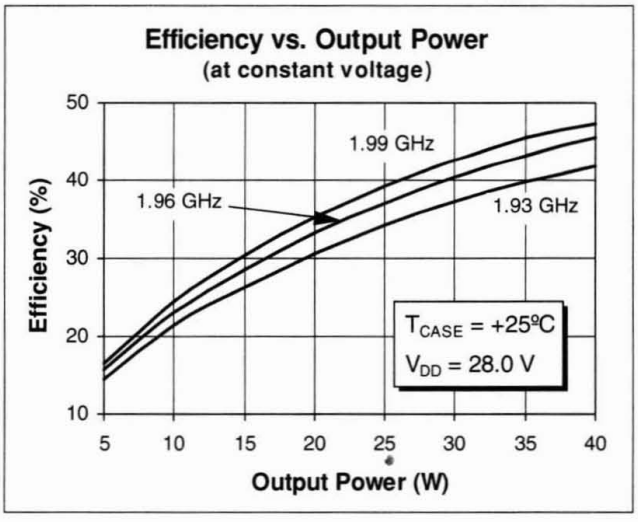
Maximum Ratings

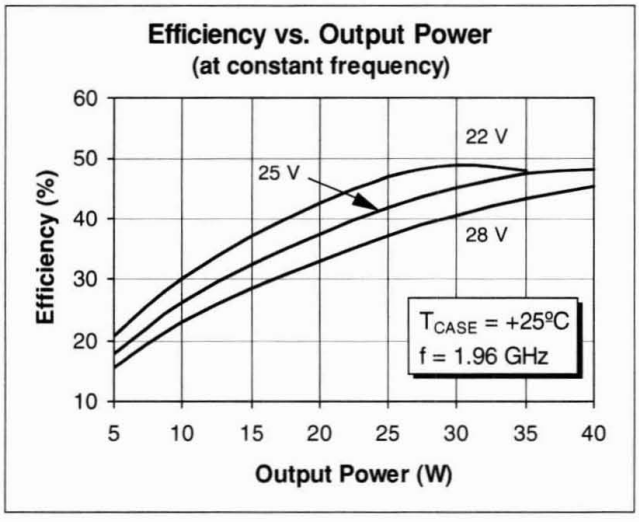
Parameter	Symbol	Value	Unit
Supply Voltage	V_{DD}	32	Vdc
Bias Current	I_{DQ}	1000	mA
Operating Current	—	4.5	A
Operating Temperature	T_{CASE}	90	°C
Total Device Dissipation at T_{CASE} = 25°C Above 25°C derate by	P_D	TBD	Watts W/°C
Storage Temperature	T_{STG}	125	°C

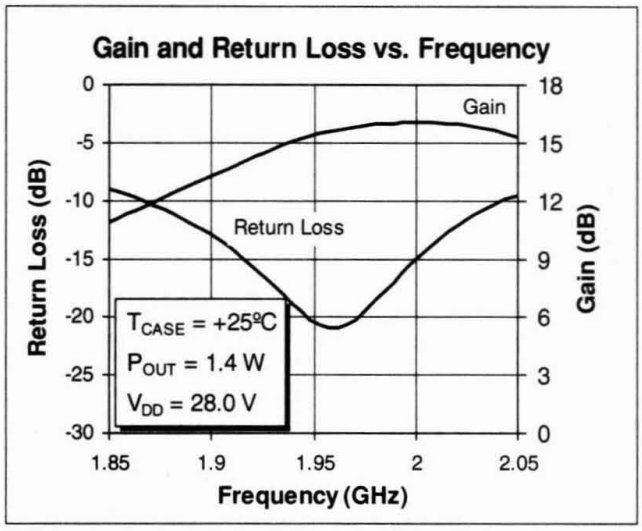
Typical Performance

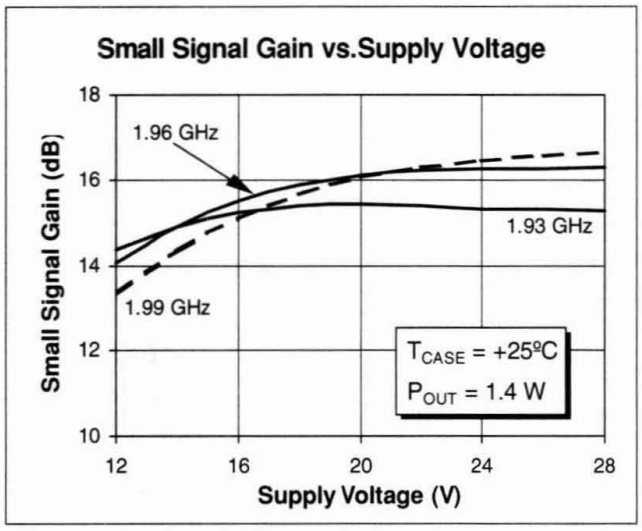


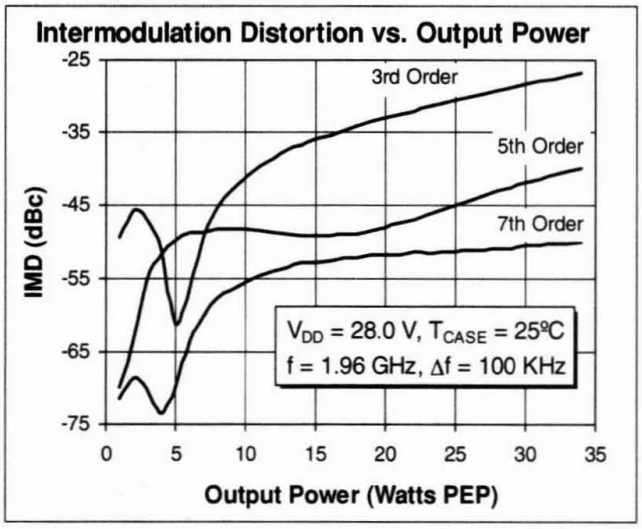


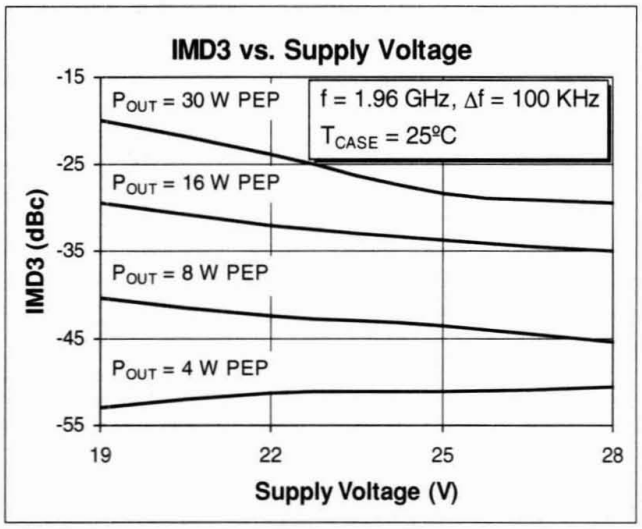


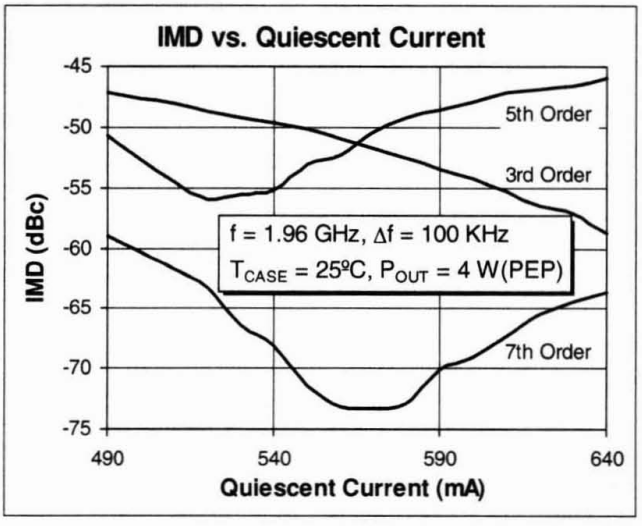


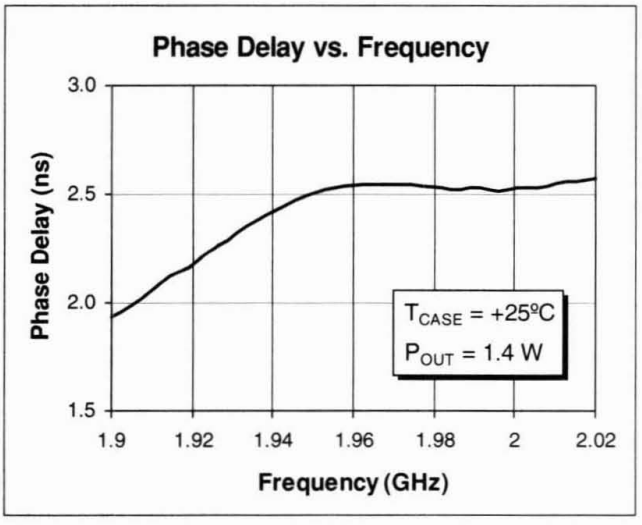

Gain and Return Loss vs. Frequency
Gain
Return Loss
T_{CASE} = +25ºC
P_{OUT} = 1.4 W
V_{DD} = 28.0 V
Return Loss (dB)
Gain (dB)
Frequency (GHz)
0
-5
-10
-15
-20
-25
-30
18
15
12
9
6
3
0
1.85
1.9
1.95
2
2.05


Small Signal Gain vs.Supply Voltage
1.96 GHz
1.93 GHz
1.99 GHz
T_{CASE} = +25ºC
P_{OUT} = 1.4 W
Small Signal Gain (dB)
Supply Voltage (V)
18
16
14
12
10
12
16
20
24
28

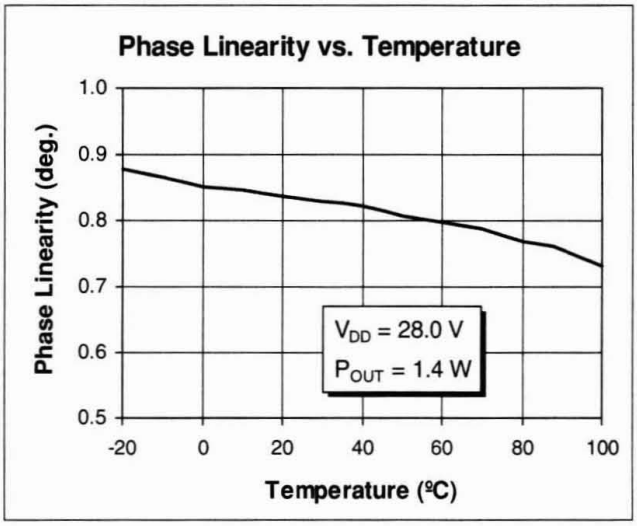

Intermodulation Distortion vs. Output Power
3rd Order
5th Order
7th Order
V_{DD} = 28.0 V, T_{CASE} = 25ºC
f = 1.96 GHz, Δf = 100 KHz
IMD (dBc)
Output Power (Watts PEP)
-25
-35
-45
-55
-65
-75
0
5
10
15
20
25
30
35

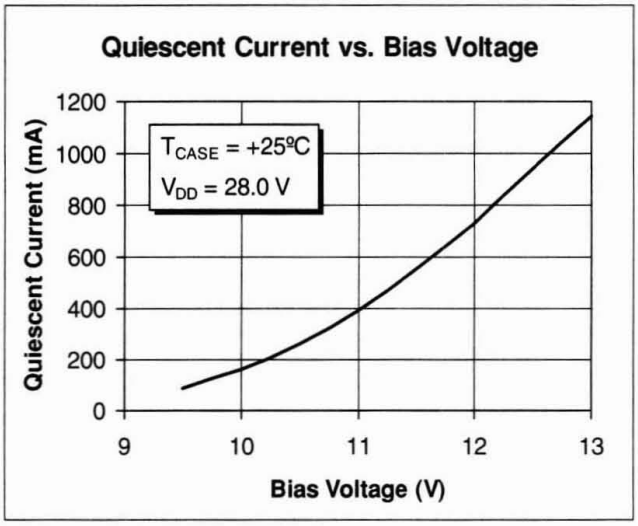

IMD3 vs. Supply Voltage
P_{OUT} = 30 W PEP
P_{OUT} = 16 W PEP
P_{OUT} = 8 W PEP
P_{OUT} = 4 W PEP
f = 1.96 GHz, Δf = 100 KHz
T_{CASE} = 25ºC
IMD3 (dBc)
Supply Voltage (V)
-15
-25
-35
-45
-55
19
22
25
28


IMD vs. Quiescent Current
5th Order
3rd Order
7th Order
f = 1.96 GHz, Δf = 100 KHz
T_{CASE} = 25ºC, P_{OUT} = 4 W(PEP)
IMD (dBc)
Quiescent Current (mA)
-45
-50
-55
-60
-65
-70
-75
490
540
590
640

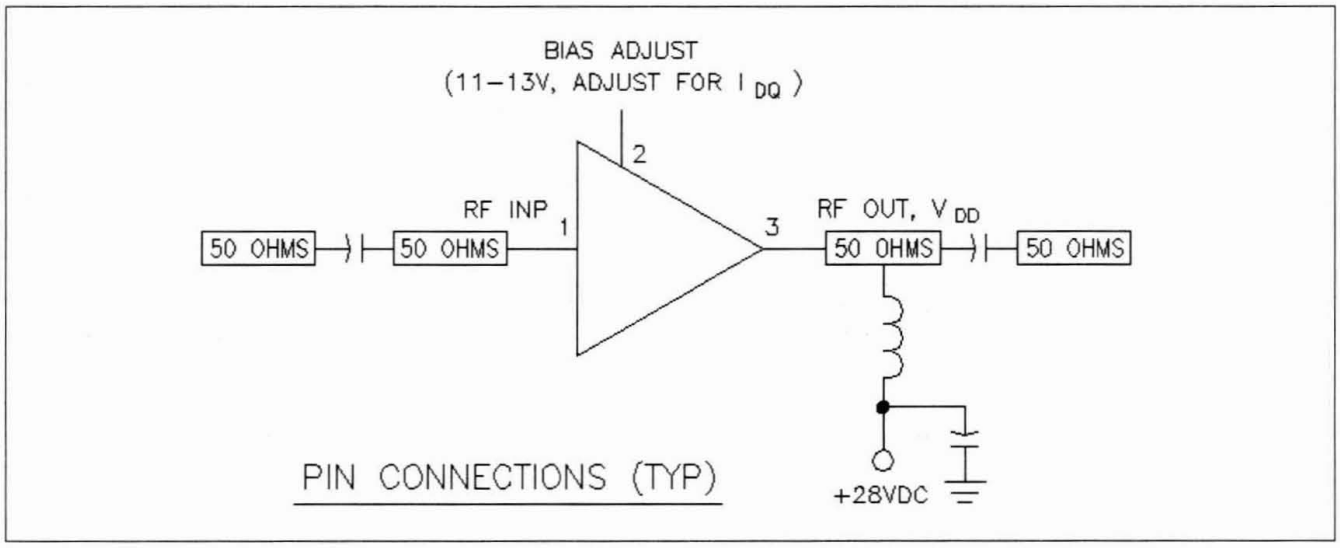

Phase Delay vs. Frequency
T_{CASE} = +25ºC
P_{OUT} = 1.4 W
Phase Delay (ns)
Frequency (GHz)
3.0
2.5
2.0
1.5
1.9
1.92
1.94
1.96
1.98
2
2.02

3





Schematic



3

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EUS/KR 1301-PTH 31002 Uen Rev. A 07-21-99

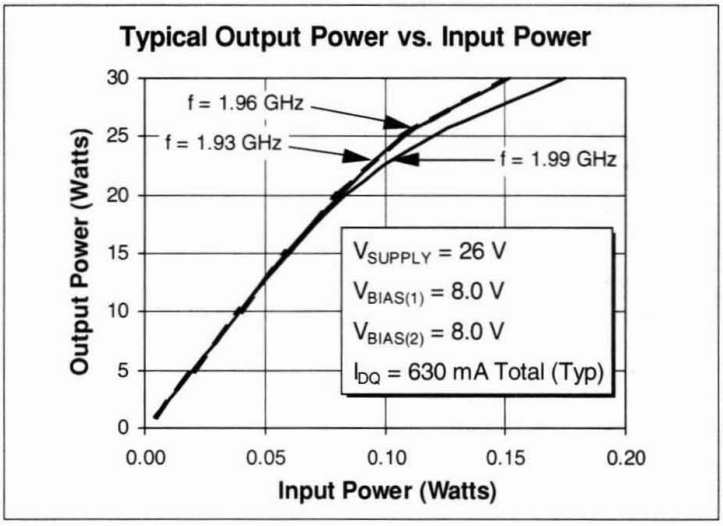
PRELIMINARY PTH 32003*

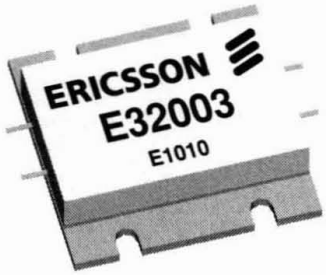
25 Watts, 1.9–2.0 GHz
50-Ohm High-Gain Power Hybrid

Description

The PTH 32003 is a high–gain 50–ohm power hybrid intended for applications requiring linear amplification and high gain in the PCS frequency range. The part is designed to operate with 50–ohm source and load impedances and includes bias circuitry with temperature compensation. This device may be used as a high–gain driver or as a final output device. The PTH 32003 simplifies system design and saves space with an overall footprint of 1.21 square inch.

- **Performance at 1.930 to 1.990 GHz, V_{SUPPLY} = 26 V, $V_{BIAS(1)}$ = 8.0 V, $V_{BIAS(2)}$ = 8.0 V**
  - **Power Gain = +24 dB Nom.**
  - **Output Power = 25 Watts (P-1dB) Typ**
  - **Small Signal Flatness = ±0.1 dB Typ**
- **Higher gain available with increased bias voltages**
- **Optimum performance guaranteed with bias voltages at 8.0 Volts**
- **Exceptional phase linearity and delay characteristics**





Package J

Performance Characteristics

Parameter	Symbol	Min	Typ	Max	Units
Frequency Range	f	1930	—	1990	MHz
Output Power at 1 dB Compressed V_{DS} (Nom.) = 26, $V_{BIAS(1)}$ = 8.0 V, $V_{BIAS(2)}$ = 8.0 V	P-1dB	—	26	—	W
Input VSWR V_{DS} (Nom.) = 26, $V_{BIAS(1)}$ = 8.0 V, $V_{BIAS(2)}$ = 8.0 V	ψ	—	1.2:1	1.5:1	—
Small Signal Gain V_{DS} (Nom.) = 26 V, $V_{BIAS(1)}$ = 8.0 V, $V_{BIAS(2)}$ = 8.0 V, $I_{DQ(1)}$ = 270 mA, $I_{DQ(2)}$ = 360 mA	P_g	—	+24	—	dB
Gain Flatness V_{DS} (Nom.) = 26 V, $V_{BIAS(1)}$ = 8.0 V, $V_{BIAS(2)}$ = 8.0 V	—	—	±0.1	TBD	dB

* Note: Specifications for this product are preliminary and subject to change without notice. Please contact your sales representative for further product information. Complete product infromation is available on our Website at: www.ericsson.com/rfpower.

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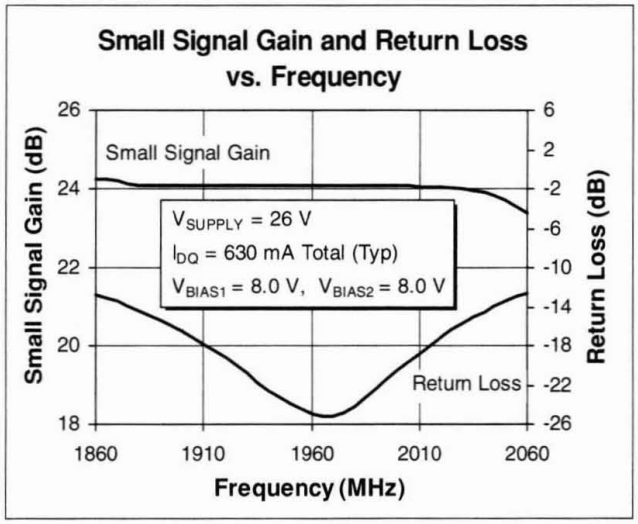
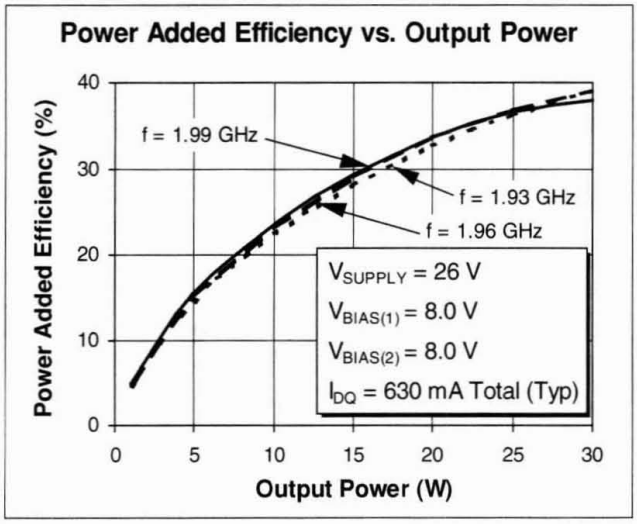
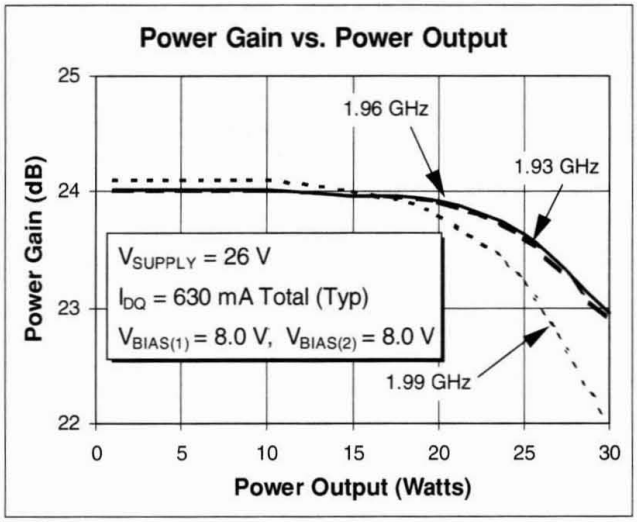
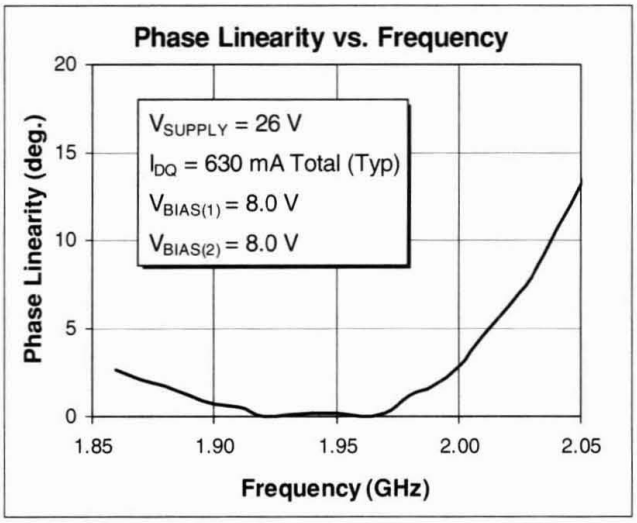
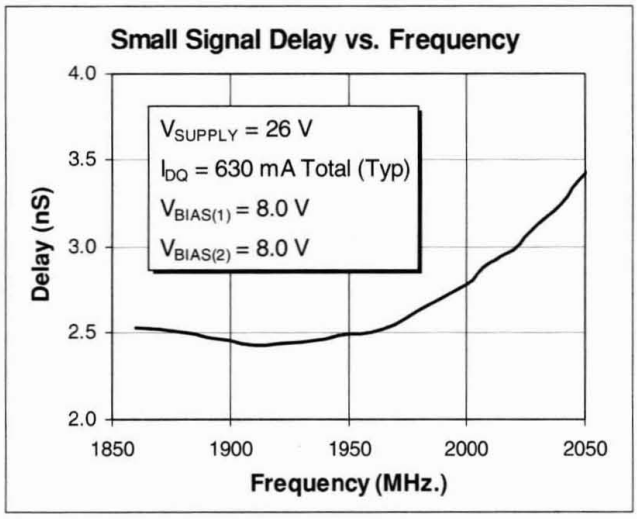
Typical Performance

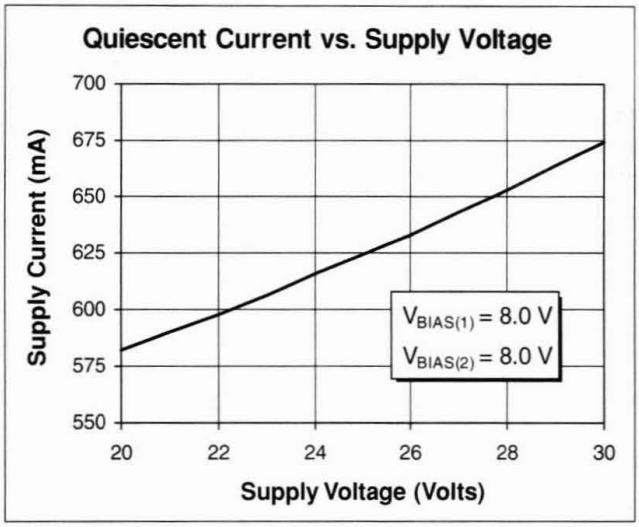


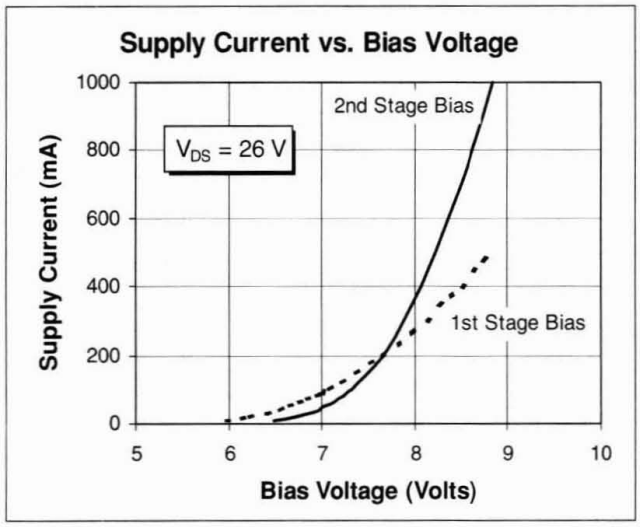


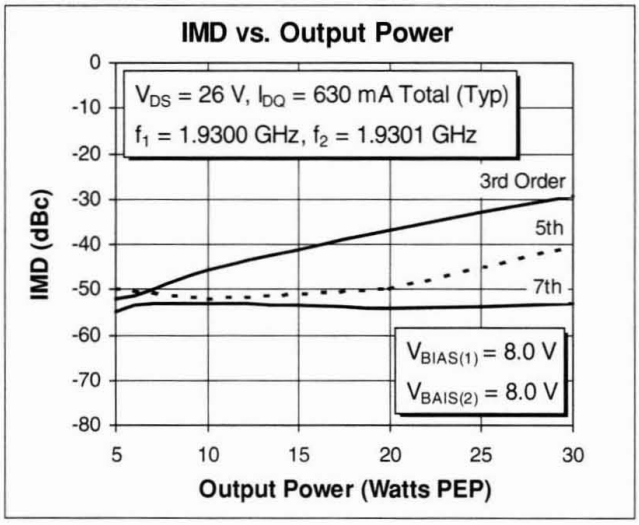


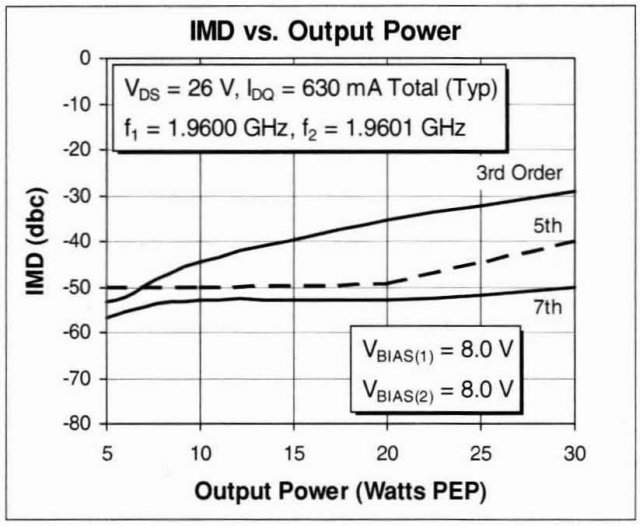


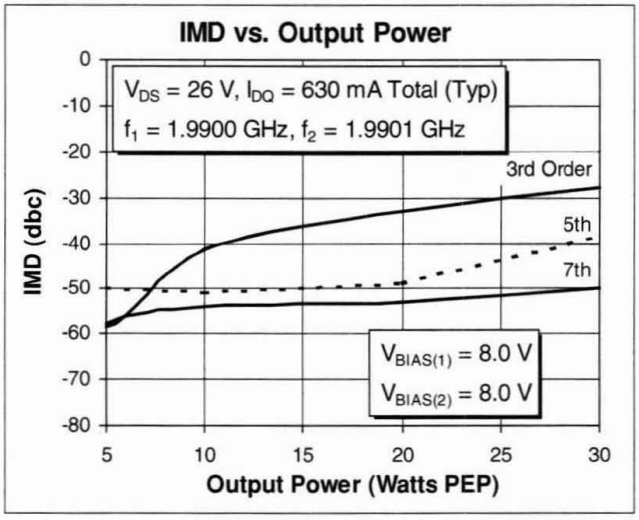



Quiescent Current vs. Supply Voltage
Supply Current (mA)
700
675
650
625
600
575
550
20
22
24
26
28
30
Supply Voltage (Volts)
$V_{BIAS(1)}$ = 8.0 V
$V_{BIAS(2)}$ = 8.0 V

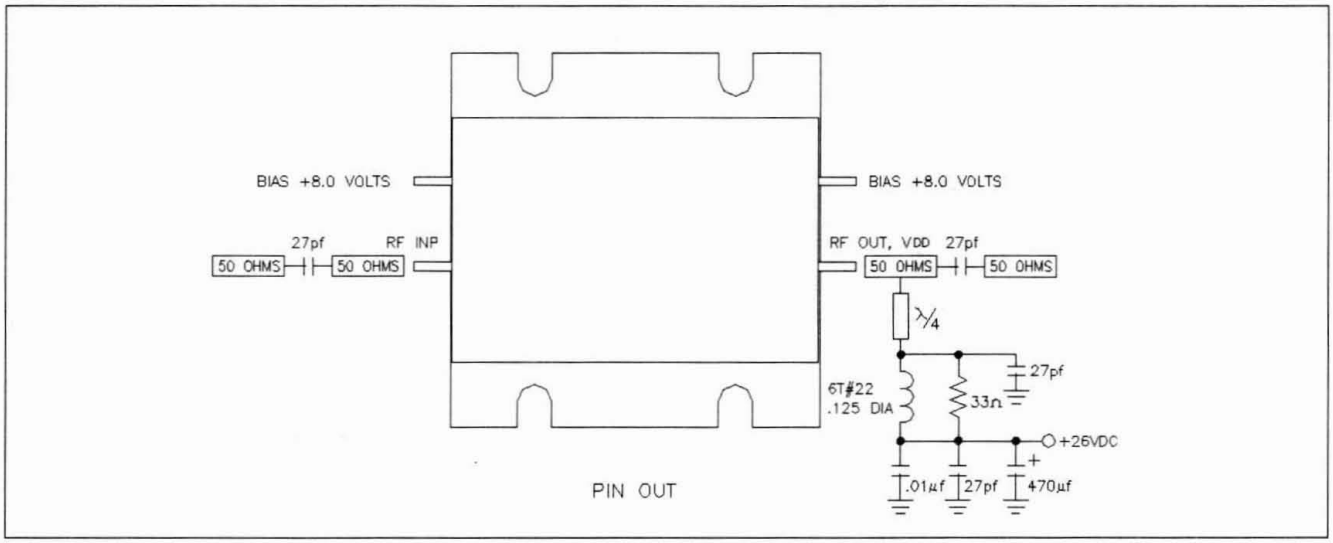

Supply Current vs. Bias Voltage
Supply Current (mA)
1000
800
600
400
200
0
5
6
7
8
9
10
Bias Voltage (Volts)
V_{DS} = 26 V
2nd Stage Bias
1st Stage Bias


IMD vs. Output Power
IMD (dBc)
0
-10
-20
-30
-40
-50
-60
-70
-80
5
10
15
20
25
30
Output Power (Watts PEP)
V_{DS} = 26 V, I_{DQ} = 630 mA Total (Typ)
f_1 = 1.9300 GHz, f_2 = 1.9301 GHz
3rd Order
5th
7th
$V_{BIAS(1)}$ = 8.0 V
$V_{BAIS(2)}$ = 8.0 V

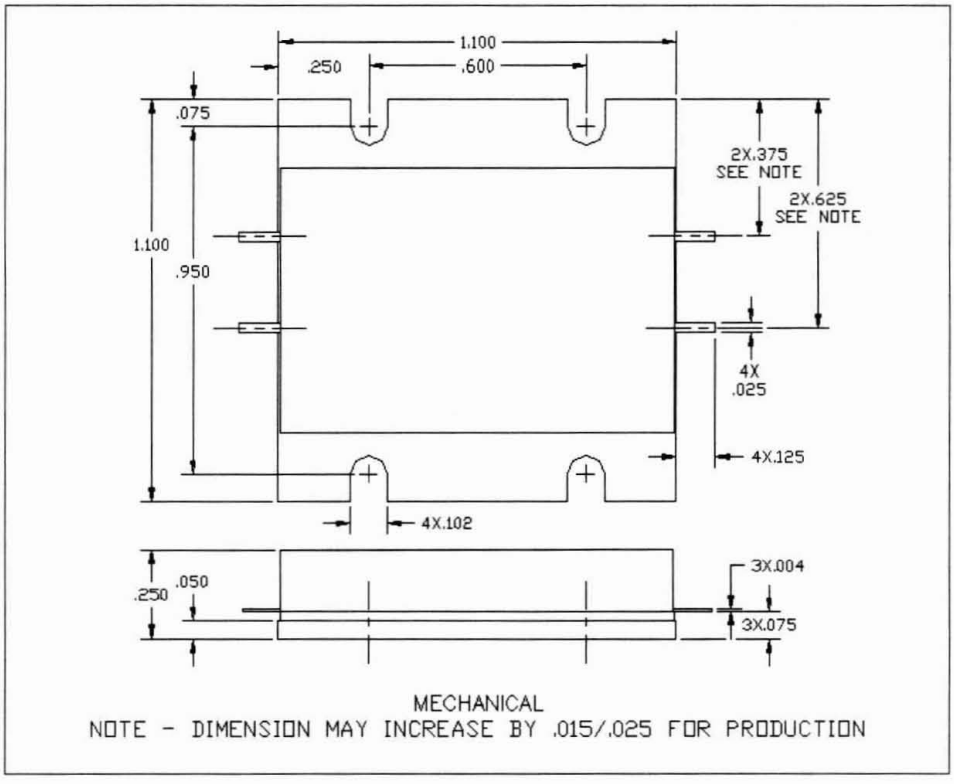

IMD vs. Output Power
IMD (dbc)
0
-10
-20
-30
-40
-50
-60
-70
-80
5
10
15
20
25
30
Output Power (Watts PEP)
V_{DS} = 26 V, I_{DQ} = 630 mA Total (Typ)
f_1 = 1.9600 GHz, f_2 = 1.9601 GHz
3rd Order
5th
7th
$V_{BIAS(1)}$ = 8.0 V
$V_{BIAS(2)}$ = 8.0 V


IMD vs. Output Power
IMD (dbc)
0
-10
-20
-30
-40
-50
-60
-70
-80
5
10
15
20
25
30
Output Power (Watts PEP)
V_{DS} = 26 V, I_{DQ} = 630 mA Total (Typ)
f_1 = 1.9900 GHz, f_2 = 1.9901 GHz
3rd Order
5th
7th
$V_{BIAS(1)}$ = 8.0 V
$V_{BIAS(2)}$ = 8.0 V

Pin Out Schematic



Package Mechanical Specifications



Package J

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Tape and Reel Specifications

Prepared by Jon Horton, Quality Assurance, RF Power Products

The embossed tape and reel process is used to facilitate automatic pick and place assembly requirements. The carrier tape is used as the shipping medium for various FET and Bipolar packaged devices. Typically, these are either surface mountable or "pill" designs, requiring a minimum of handling. The antistatic / conductive carrier tape provides a secure envelope for product and is sealed with cover tape, which has the same antistatic / conductive properties.

Standards:

- 13" reel size standard
- 16mm tape width standard
- Used for automatic pick and place feed systems
- Minimizes product handling
- EIA 481-1 –2

Conductive Embossed Carrier Tapes:

These carrier tapes use high impact polystyrene with a special modified styrenic alloy material. The result is a low and stable surface resistivity, consistent sealing strength, with a smooth and flat flange surface.

General Properties*

		METHOD	VALUE
Specific Gravity		JIS-K-7112	1.06
Tensile Strength	MD	JIS-K-7113	4.00 kg/mm^2
	TD		3.70 kg/mm^2
Elongation	MD	JIS-K-7113	50 %
	TD		45 %
Surface Resistivity		JIS-K-6911	10E5 ohms/sq.
Dupont Drop Impact Strength		—	110 kgf.cm
Flexural Strength		JIS-K-7203	700kgf/cm^2
Softening Temperature		JIS-K-7206	105 - 110°C
Rockwell Hardness		JIS-K-7202	112 M
			84 L
			93 R

Cover Tape

The cover tape is transparent with an antistatic coating on both sides. It heats uniformly over a wide range of temperatures to ensure a good seal and is suitable for sealing a variety of different compositions of carrier tapes.

The adhesive system is specially developed for a tight range in seal strength, as well as its stable seal strength.

General Properties*

		METHOD	VALUE
Break Strength	MD	JIS-Z-1702	4.00 kg / mm^2
	TD		4.63 kg / mm^2
Elongation	MD	JIS-Z-1702	901 %
	TD		64 %
Mode of Elasticity	MD	JIS-Z-1702	90 kg / mm^2
	TD		90 kg / mm^2
Tear Strength	MD	JIS-Z-1702	11 kg/mm^2
	TD		10 kg/mm^2
Clearness	JIS-K-6714		75% Total Light Transmission
Surface Resistivity			$\leq 10^{11}$ ohms/sq. (both sides)
Adhesion to Carrier Tape		EIA 481	20 - 80 gms
Width			13.1mm
Width Tolerance			+/- 0.1 mm
Thickness			0.055 to 0.075 mm
Length			(as required)
Base Material			Polyester

*Typical Values only

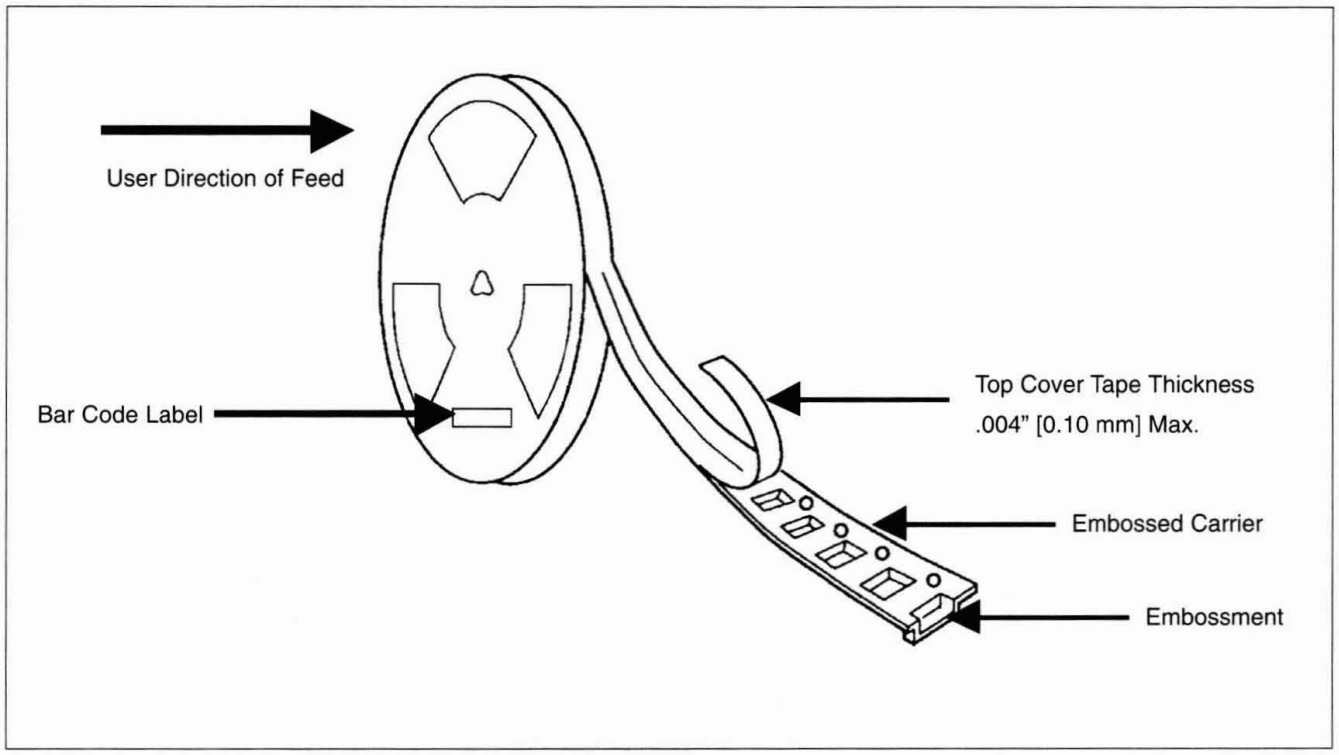
Plastic Packaging Reel

The plastic resins used in the reel have been specially chosen to have a good balance of physical and mechanical properties. These reels are recommended for packaging and electronic product handling applications, where freedom from the hazard of electrostatic discharge is necessary.

The reels are a standard 13" inch size diameter with a 4" hub, featuring an antistaic coating.

General Characteristics

- Reel material : Polystyrene
- Surface resistivity : 10^9 -10^{11} ohms/ sq. (Antistatic)
- Color available : Neptune Blue



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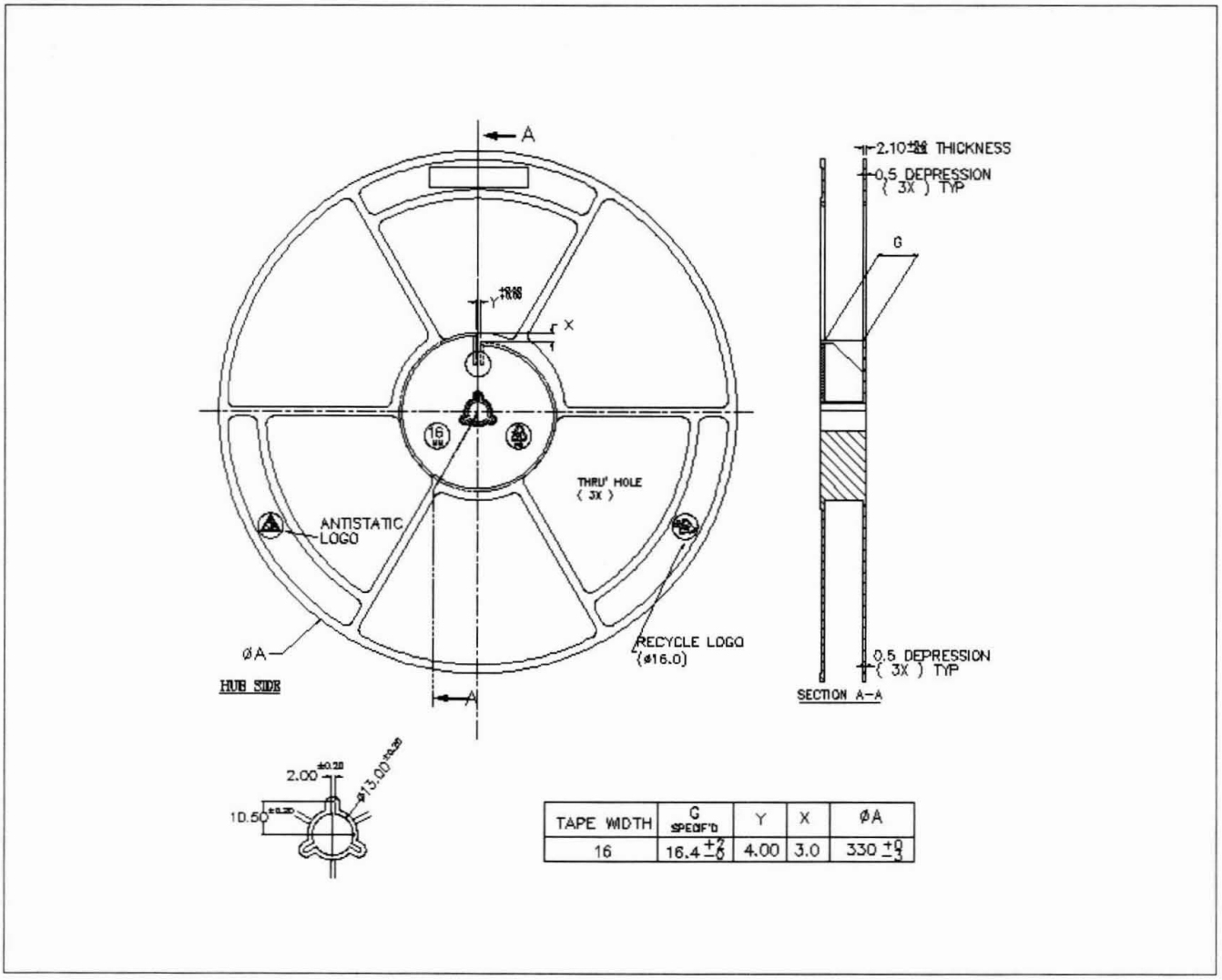
Dimensional Information (mm)*

Tape Product	Ao	Bo	Ko	F	P 1	W
PNK 20208	7.77 +/- 0.1	5.73 +/- 0.1	2.80 +/- 0.1	7.50 +/- 0.1	12.00 +/- 0.1	16.00 +/- 0.3
PNK 20227	5.90 +/- 0.1	6.90 +/- 0.1	2.40 +/- 0.1	7.50 +/- 0.1	8.00 +/- 0.1	16.00 +/- 0.3
PNK 20232	6.90+/- 0.1	10.40 +/- 0.1	3.0 +/- 0.1	7.50 +/- 0.1	12.00 +/- 0.1	16.00 +/- 0.3
PNK 20239	7.77 +/- 0.1	5.73 +/- 0.1	2.80 +/- 0.1	7.50 +/- 0.1	12.00 +/- 0.1	16.00 +/- 0.3
PNK 20243	6.90+/- 0.1	10.40 +/- 0.1	3.0 +/- 0.1	7.50 +/- 0.1	12.00 +/- 0.1	16.00 +/- 0.3
PNK 20244	4.46 +/- 0.1	5.73 +/- 0.1	2.86 +/- 0.1	7.50 +/- 0.1	12.00 +/- 0.1	16.00 +/- 0.3
PNK 20249	4.46 +/- 0.1	5.73 +/- 0.1	2.86 +/- 0.1	7.50 +/- 0.1	12.00 +/- 0.1	16.00 +/- 0.3

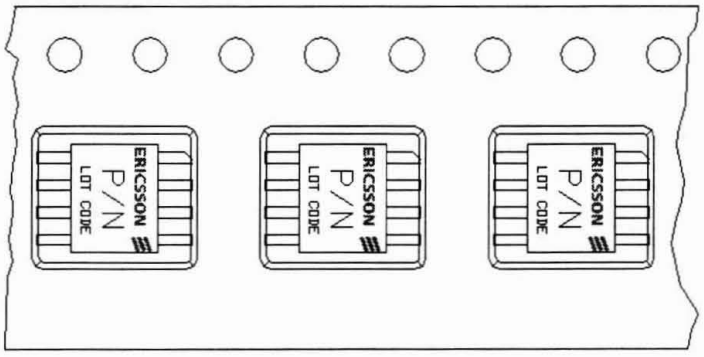
*See drawings on following pages.

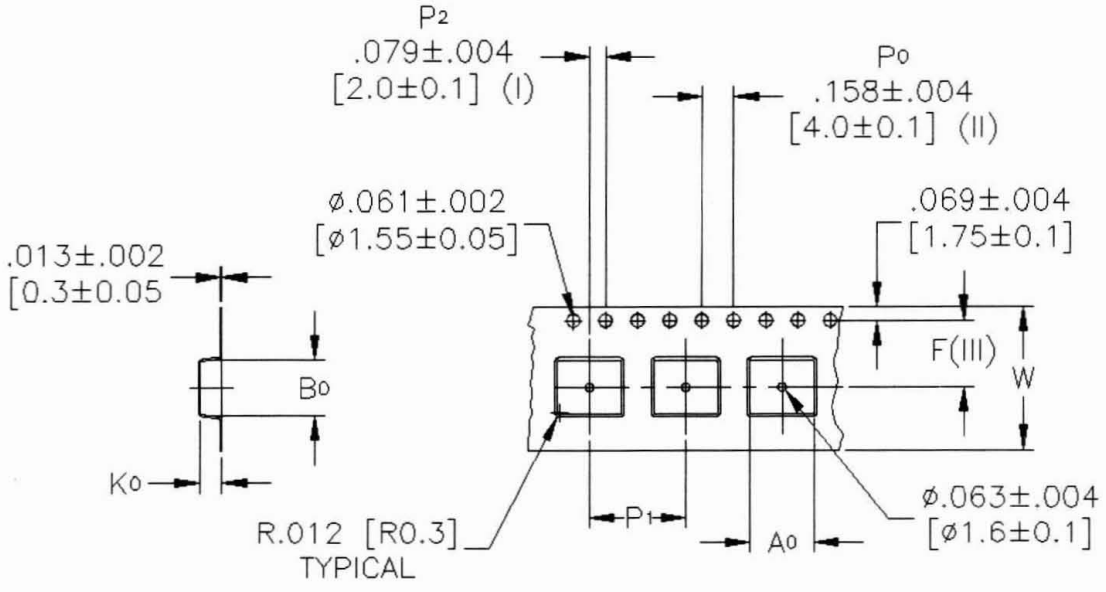


TAPE WIDTH	G SPECIFIED	Y	X	ØA
16	16.4 +2 -0	4.00	3.0	330 +0 -3

Product Orientation and Tape Dimensions

PNK 20208 or PNK 20239





(I) Measured from centerline of sprocket hole to centerline of pocket

(II) Cumulative tolerance of 10 sprocket holes is +/- .020

(III) Measured from centerline of sprocket hole to centerline of pocket

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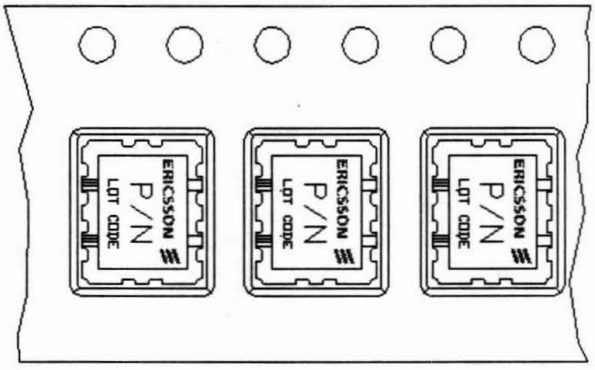
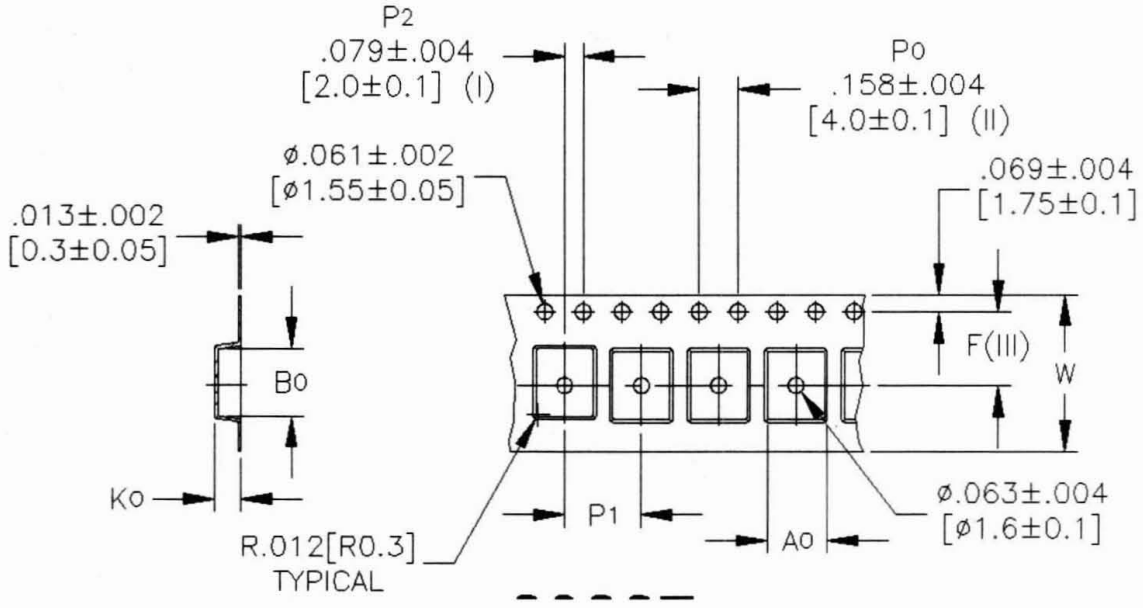
Product Orientation and Tape Dimensions

PNK 20227





(I) Measured from centerline of sprocket hole to centerline of pocket

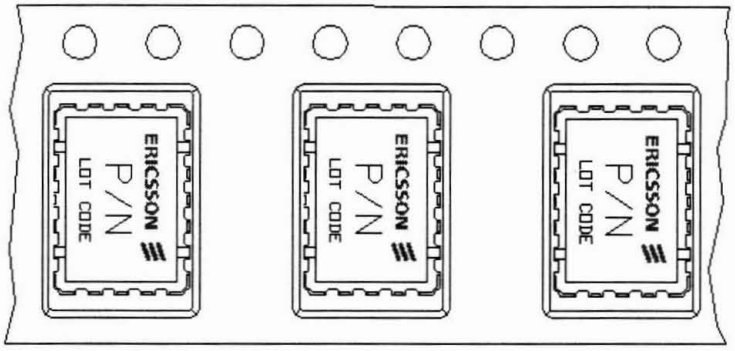
(II) Cumulative tolerance of 10 sprocket holes is +/- .020

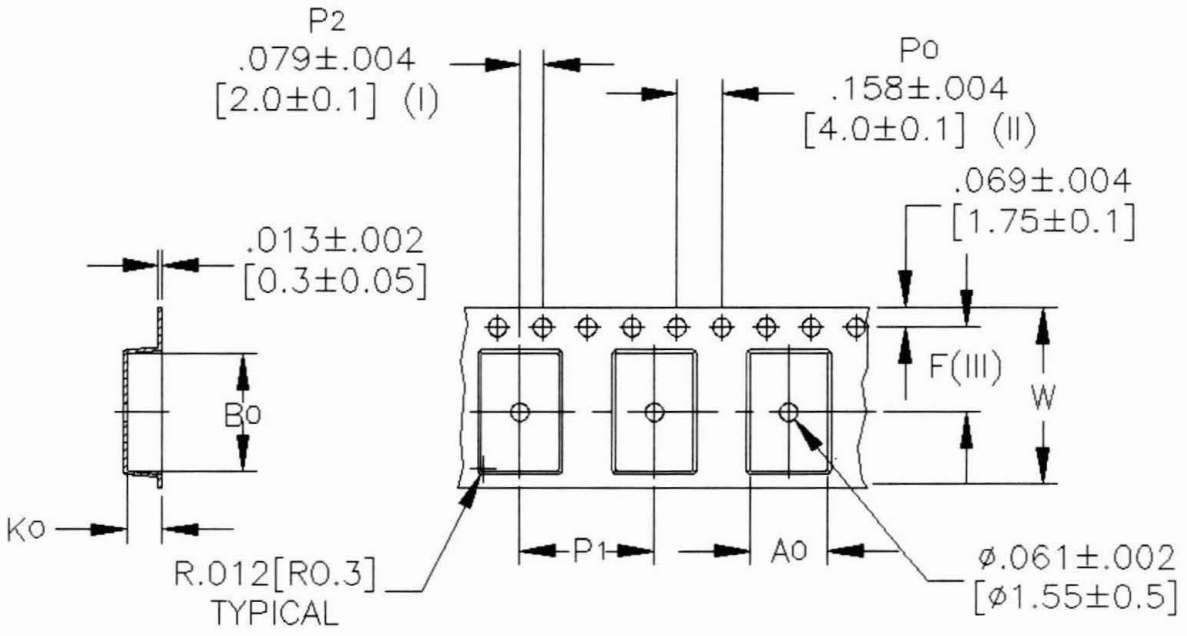
(III) Measured from centerline of sprocket hole to centerline of pocket

4

Product Orientation and Tape Dimensions

PNK 20232 or PNK 20243





(I) Measured from centerline of sprocket hole to centerline of pocket

(II) Cumulative tolerance of 10 sprocket holes is +/- .020

(III) Measured from centerline of sprocket hole to centerline of pocket

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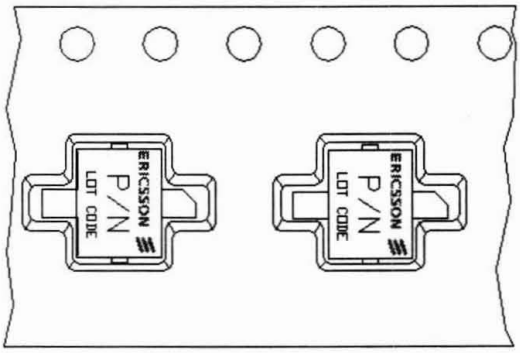
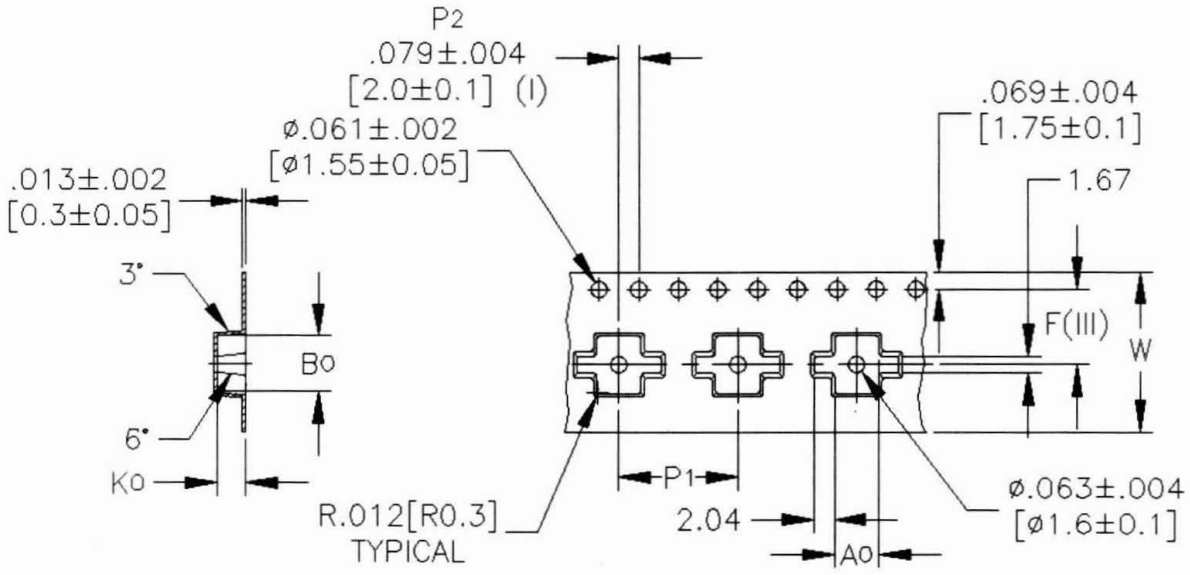
Product Orientation and Tape Dimensions

PNK 20244 or PNK 20249





(I) Measured from centerline of sprocket hole to centerline of pocket

(II) Cumulative tolerance of 10 sprocket holes is +/- .020

(III) Measured from centerline of sprocket hole to centerline of pocket

4

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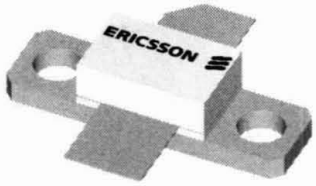
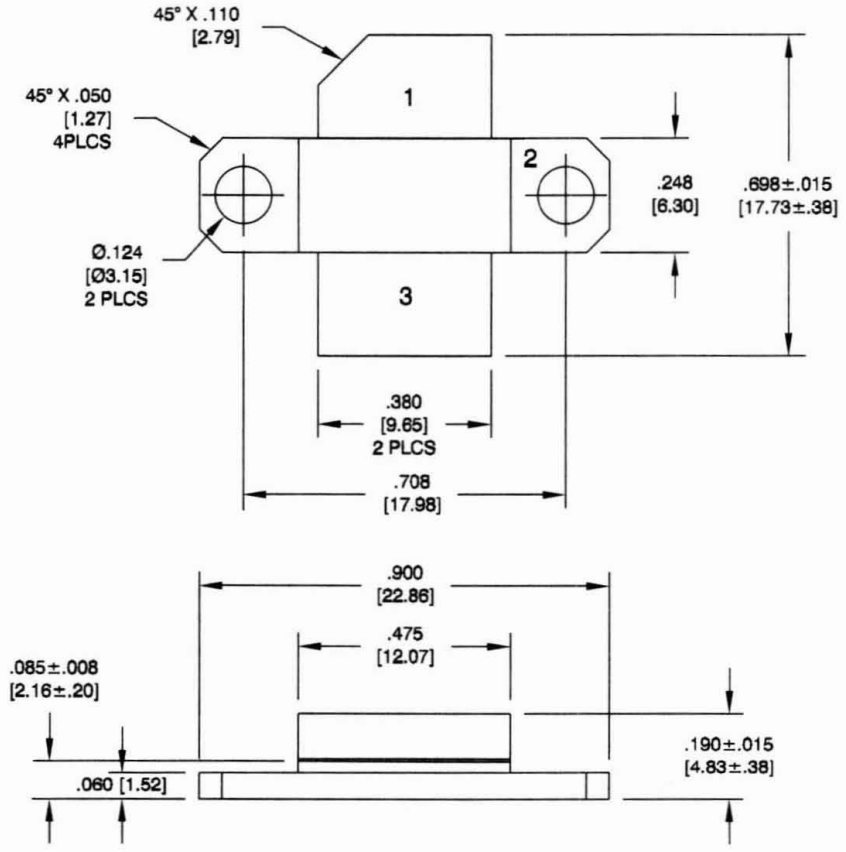
Unless otherwise noted, lids are toleranced with reference to the leads.

Primary dimensions are inches; alternate dimensions are mm.

Package 20222





Unless otherwise specified
all tolerance ±0.005" [0.13mm]

Pin CE: 1.Collector 2.Emitter 3.Base
Pin CB: 1.Collector 2.Base 3.Emitter
Lead Thickness: 0.005+0.001/-0.002"
[0.13 +0.03/-0.05mm]

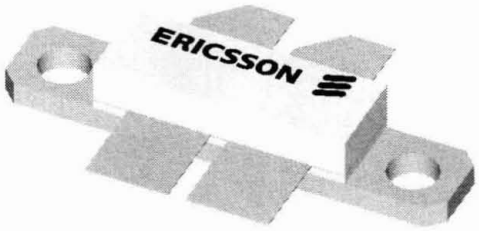
4

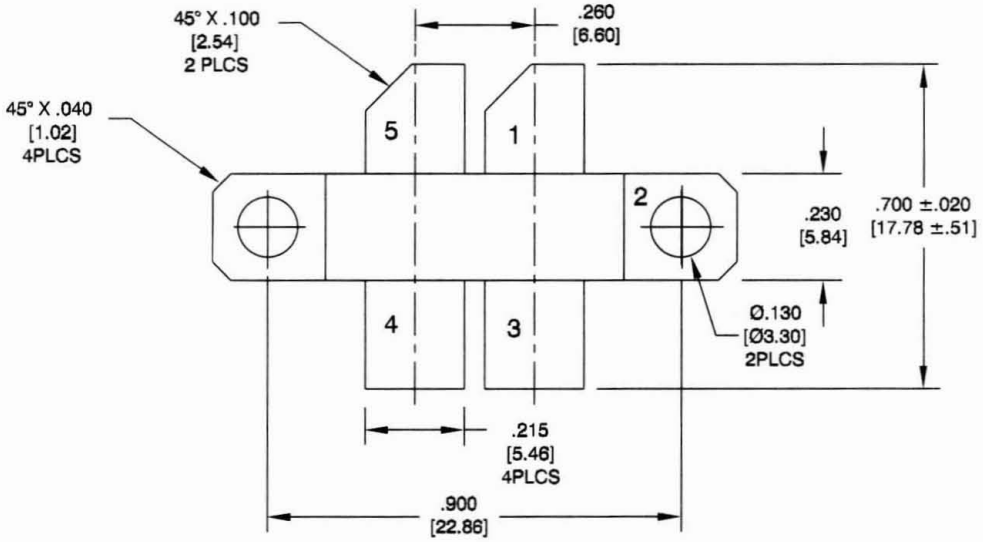
ERICSSON

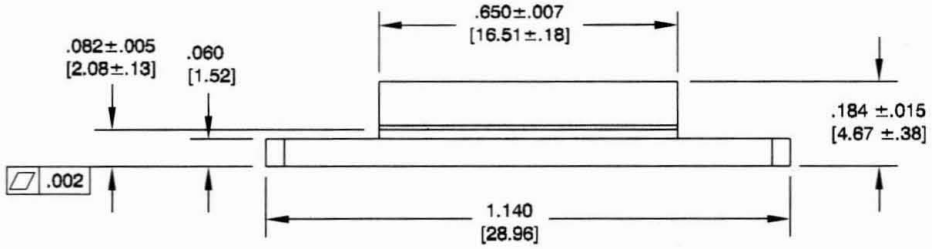
Unless otherwise noted, lids are toleranced with reference to the leads.

Primary dimensions are inches; alternate dimensions are mm.

Package 20230







Unless Otherwise Specified
all tolerance ±0.005" [0.13mm]

Pins: 1,5 Drain 2. Source 3,4 Gate
Lead Thickness: 0.004 +0.002/-0.001"
[0.10 +0.05/-0.03mm]

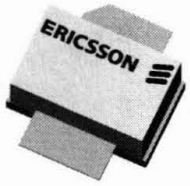
4

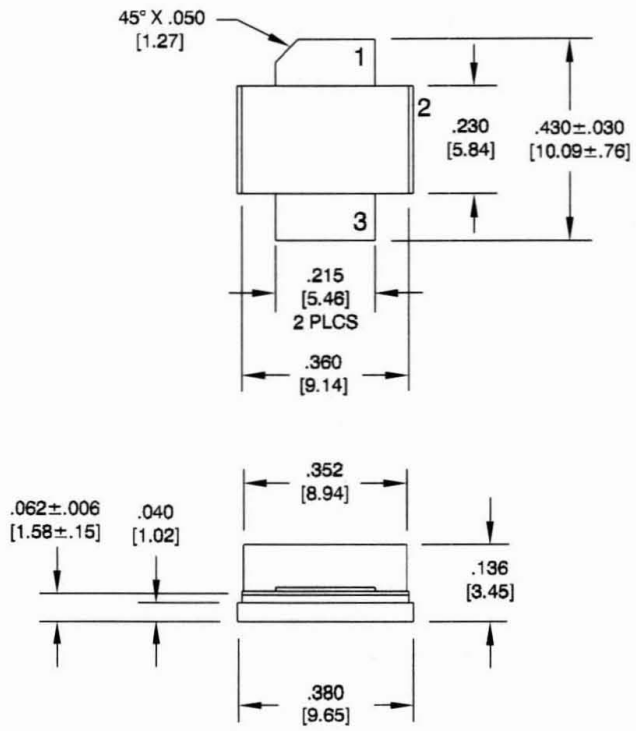
ERICSSON

Unless otherwise noted, lids are toleranced with reference to the leads.

Primary dimensions are inches; alternate dimensions are mm.

Package 20235





Unless otherwise specified
all tolerances ±.005 [0.13mm]

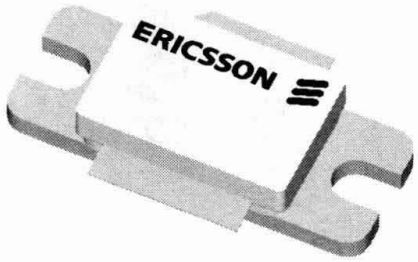
Pins: 1.Drain 2.Source 3.Gate
Lead Thickness: 0.005+0.001/-0.002"
[0.13 +0.03/-0.05mm]

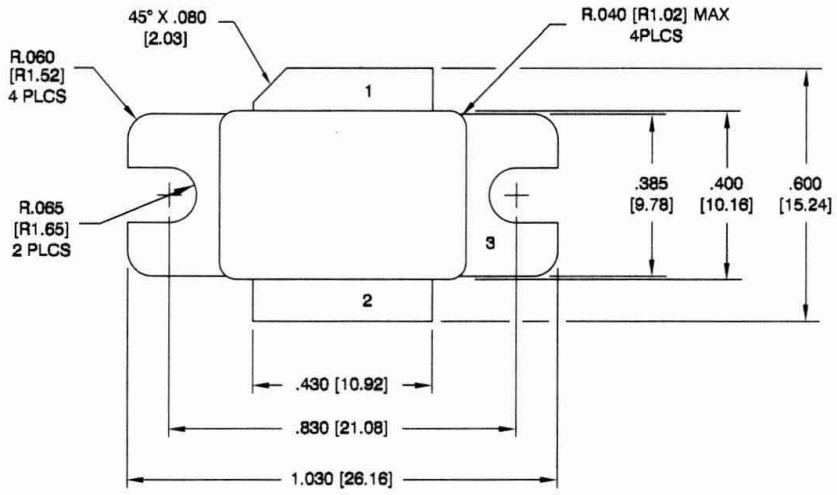
ERICSSON

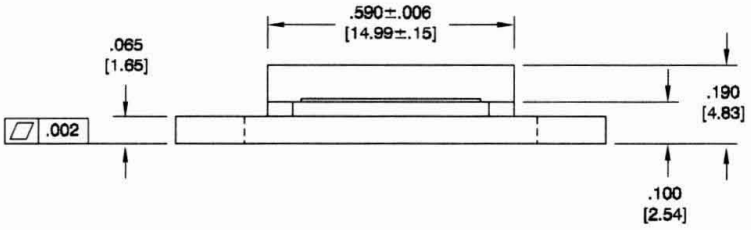
Unless otherwise noted, lids are toleranced with reference to the leads.

Primary dimensions are inches; alternate dimensions are mm.

Package 20237







Unless Otherwise Specified
all tolerance ±0.005" [0.13mm]

Pins: 1.Drain 2.Gate 3.Source
Lead Thickness: 0.005 +0.002/-0.001"
[0.13 +0.05/-0.03mm]

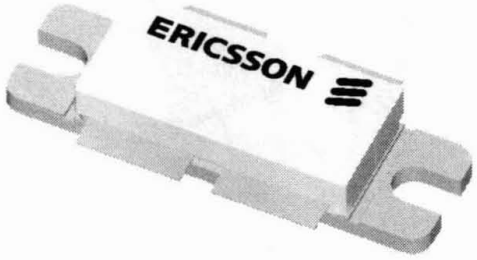
4

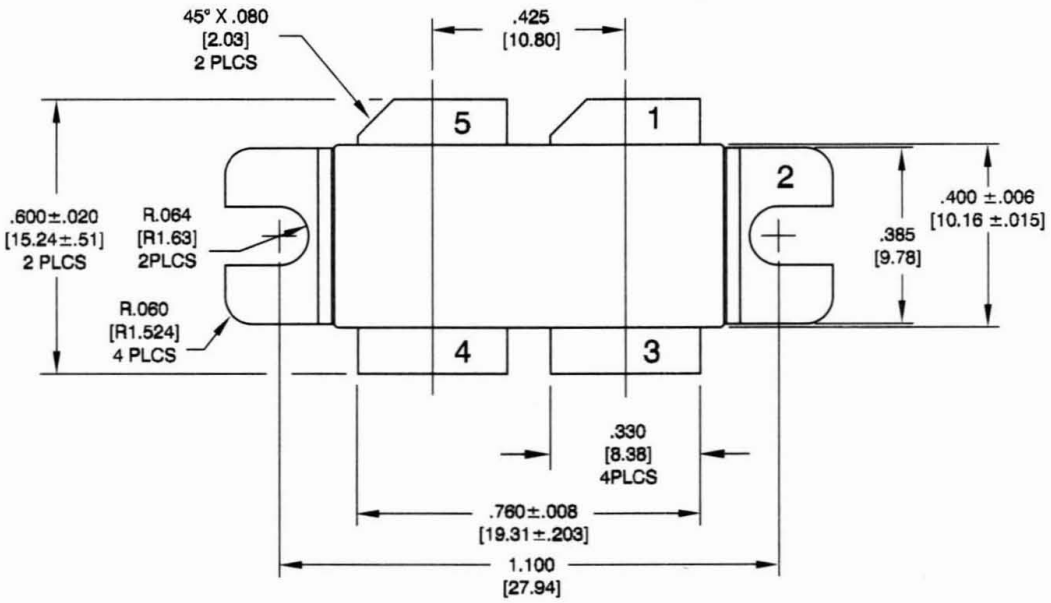
ERICSSON

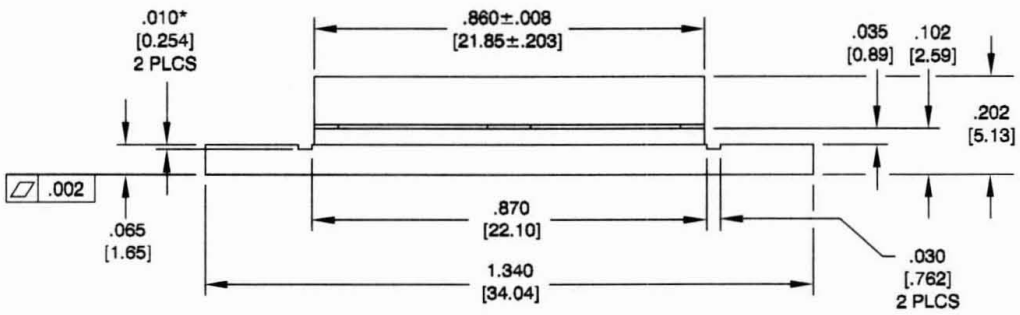
Unless otherwise noted, lids are toleranced with reference to the leads.

Primary dimensions are inches; alternate dimensions are mm.

Package 20240







Unless otherwise specified
all tolerance ±0.005 [0.13mm]
Tolerance at * +.008/-.003" [+0.20/-0.08mm]

Pins: 1.5.Drain 2.Source 3.4.Gate
Lead Thickness: 0.005±0.001" [0.13±0.03mm]

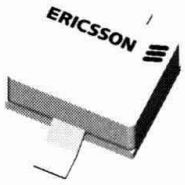
4

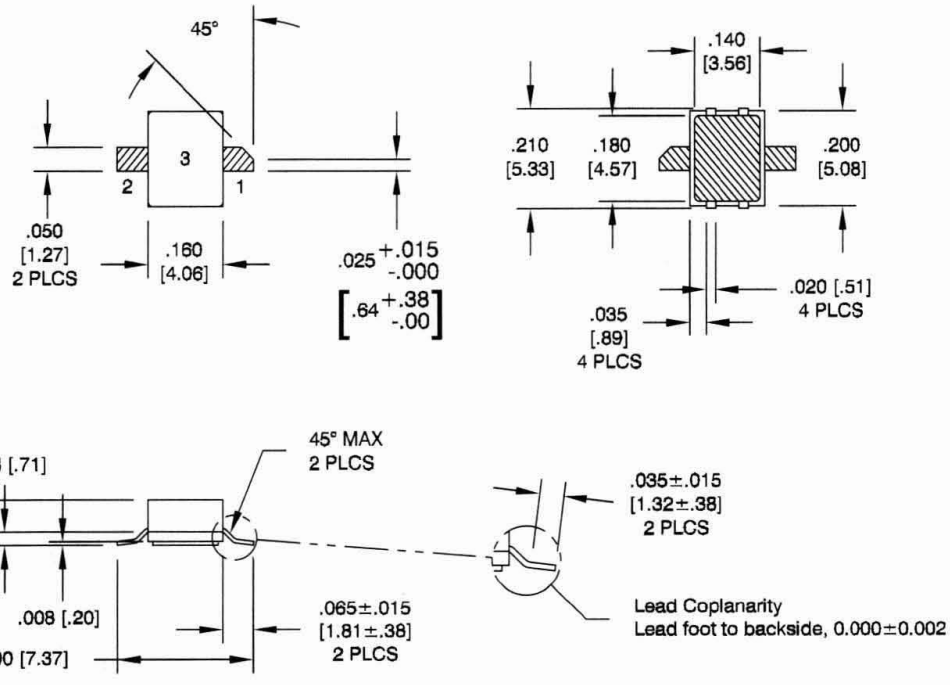
ERICSSON

Unless otherwise noted, lids are toleranced with reference to the leads.

Primary dimensions are inches; alternate dimensions are mm.

Package 20244





Unless otherwise specified
all tolerance ±0.005" [0.13mm]

Pins: 1. Drain 2. Gate 3. Source
Lead Thickness: 0.008±0.001" [0.20±0.03mm]

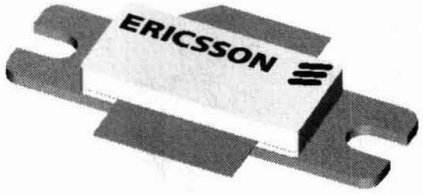
4

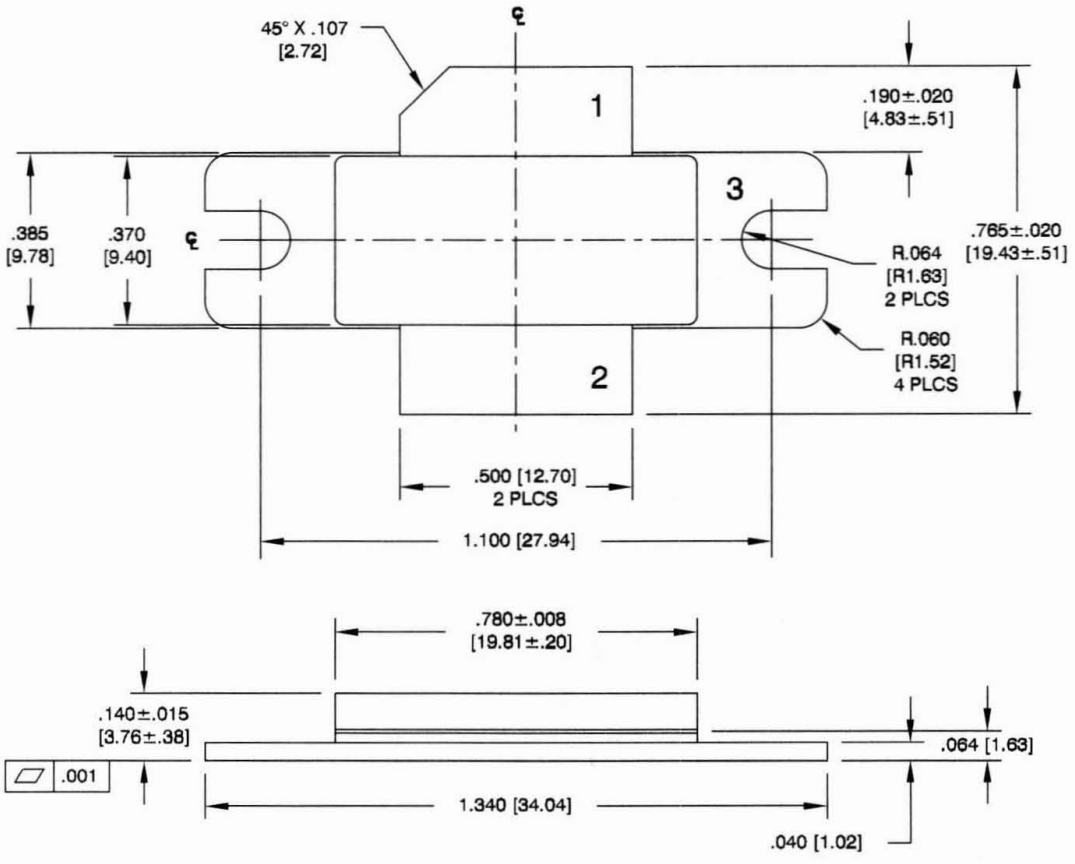
ERICSSON

Unless otherwise noted, lids are toleranced with reference to the leads.

Primary dimensions are inches; alternate dimensions are mm.

Package 20248





Unless otherwise specified
all tolerance ±0.005" [0.13mm]

Pins: 1. Drain 2. Gate 3. Source
Lead Thickness: 0.004 +0.002/-0.001"
[0.10 +.05/-0.03mm]

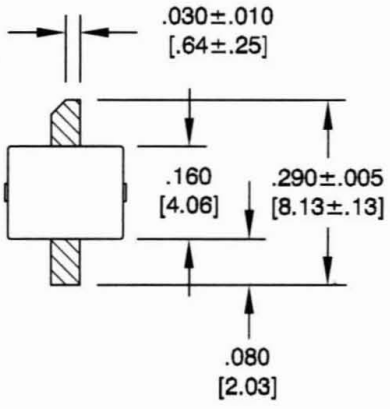
4

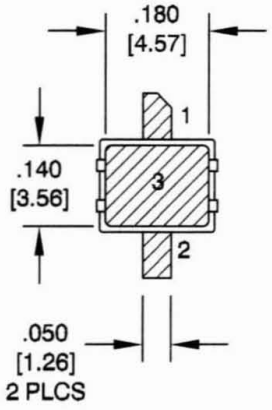
ERICSSON

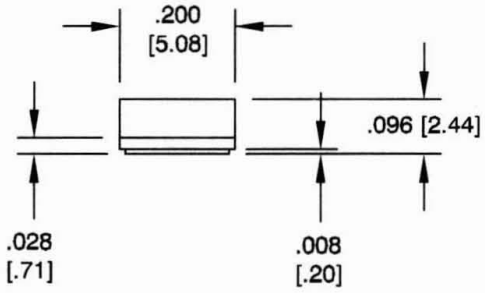
Unless otherwise noted, lids are toleranced with reference to the leads.

Primary dimensions are inches; alternate dimensions are mm.

Package 20249







Unless otherwise specified
all tolerance ±0.005" [0.13mm]

Pins: 1. Drain 2. Gate 3. Source
Lead Thickness: 0.008±0.001" [0.20±0.03mm]

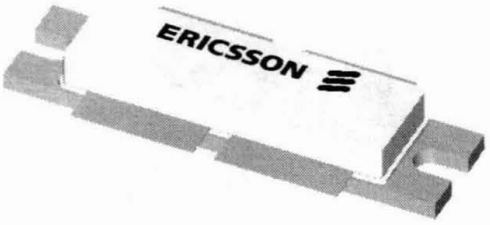
4

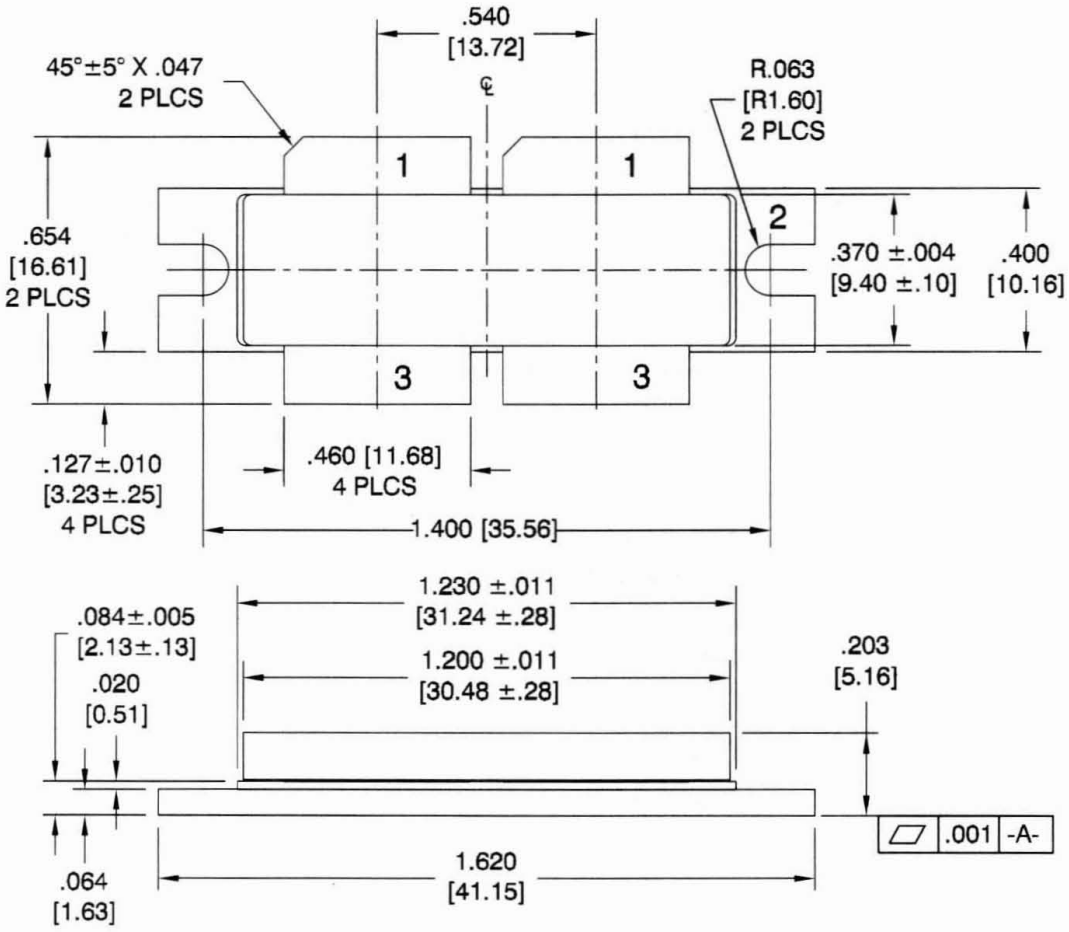
ERICSSON

Unless otherwise noted, lids are toleranced with reference to the leads.

Primary dimensions are inches; alternate dimensions are mm.

Package 20250





Unless otherwise specified
all tolerance ±.005" [0.13mm]

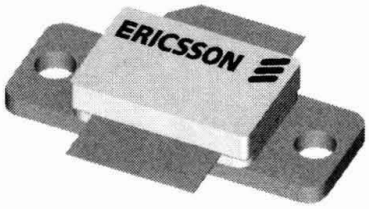
Pins: 1. Drain 2. Source 3. Gate
Lead Thickness: .004 +.002/-.001"
[0.10 +0.05/-0.03mm]

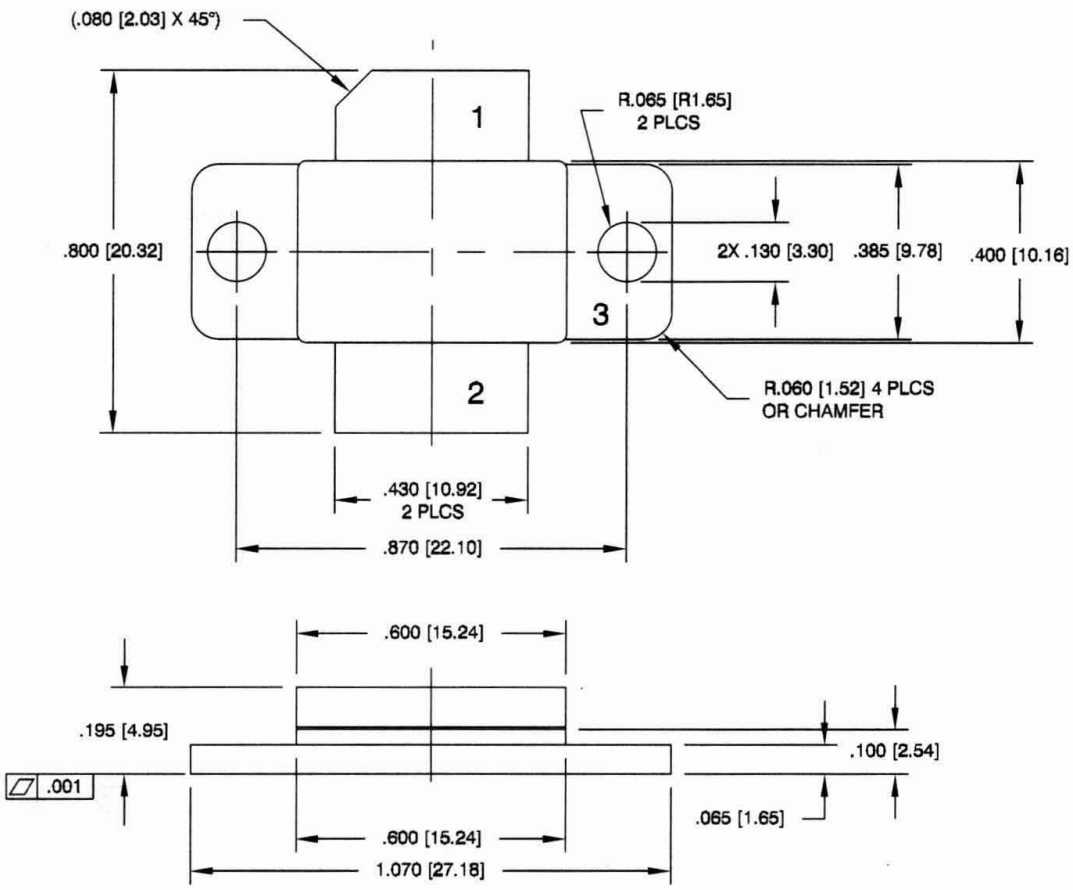
ERICSSON

Unless otherwise noted, lids are toleranced with reference to the leads.

Primary dimensions are inches; alternate dimensions are mm.

Package 20252





Unless otherwise specified
all tolerances ±.005" [0.13mm]

Pins: 1. Drain 2. Gate 3. Source
Lead Thickness: .005 +.002/-.001"
[0.13 +0.05/-0.03]

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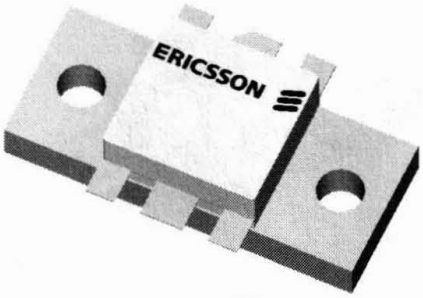
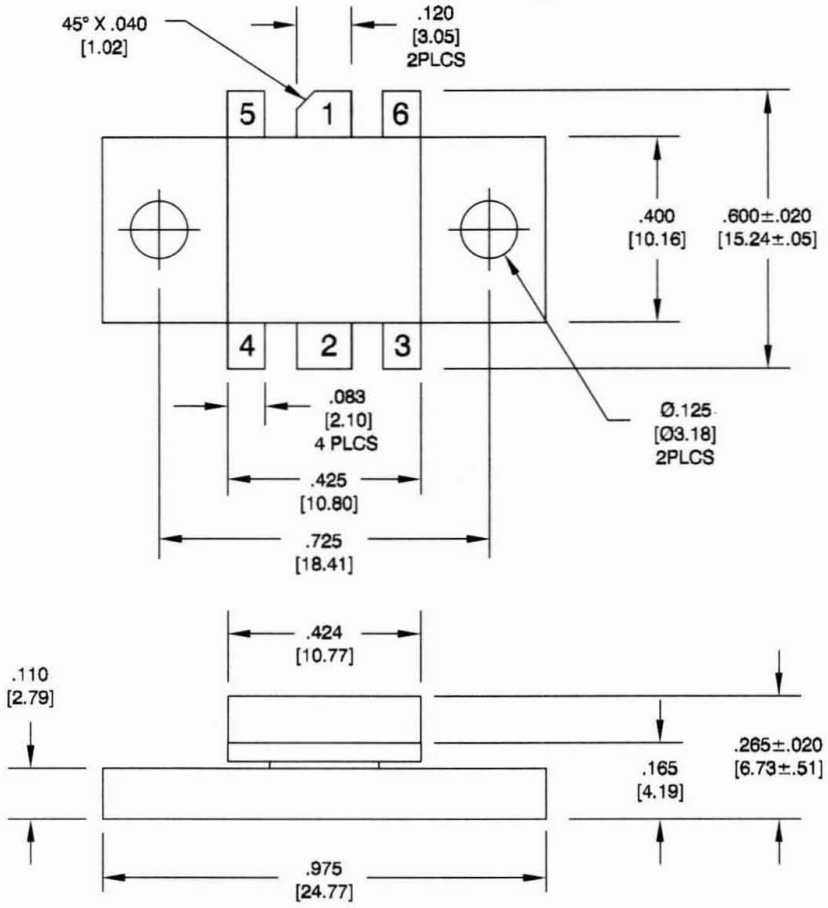
ERICSSON

Unless otherwise noted, lids are toleranced with reference to the leads.

Primary dimensions are inches; alternate dimensions are mm.

Package 20200





Unless Otherwise Specified
all tolerance ±0.005" [0.13mm]

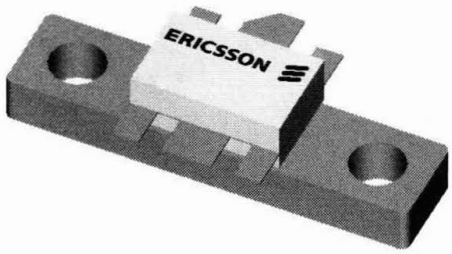
Pin CE: 1.Collector 2.Base 3.4.5.6.Emitter
Pin CB: 1.Collector 2.Emitter 3.4.5.6.Base
Lead Thickness: 0.005±0.001" [0.13±0.03mm]

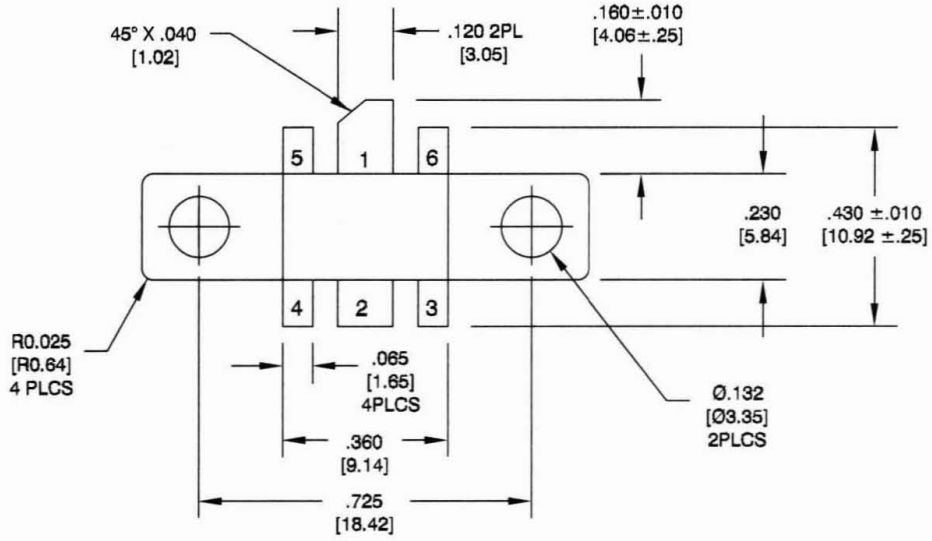
ERICSSON

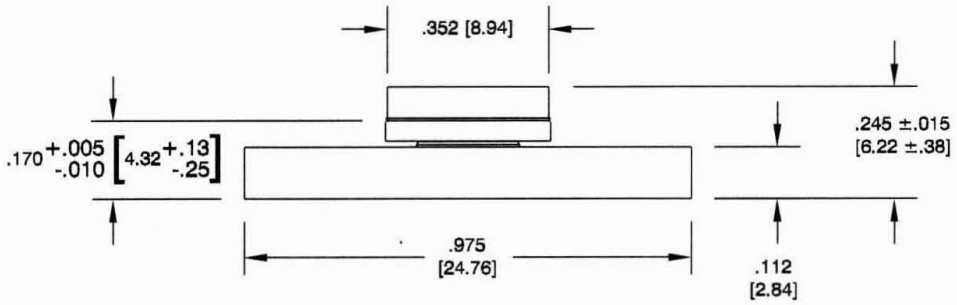
Unless otherwise noted, lids are toleranced with reference to the leads.

Primary dimensions are inches; alternate dimensions are mm.

Package 20201







Unless Otherwise Specified
all tolerance ±0.005" [0.13mm]

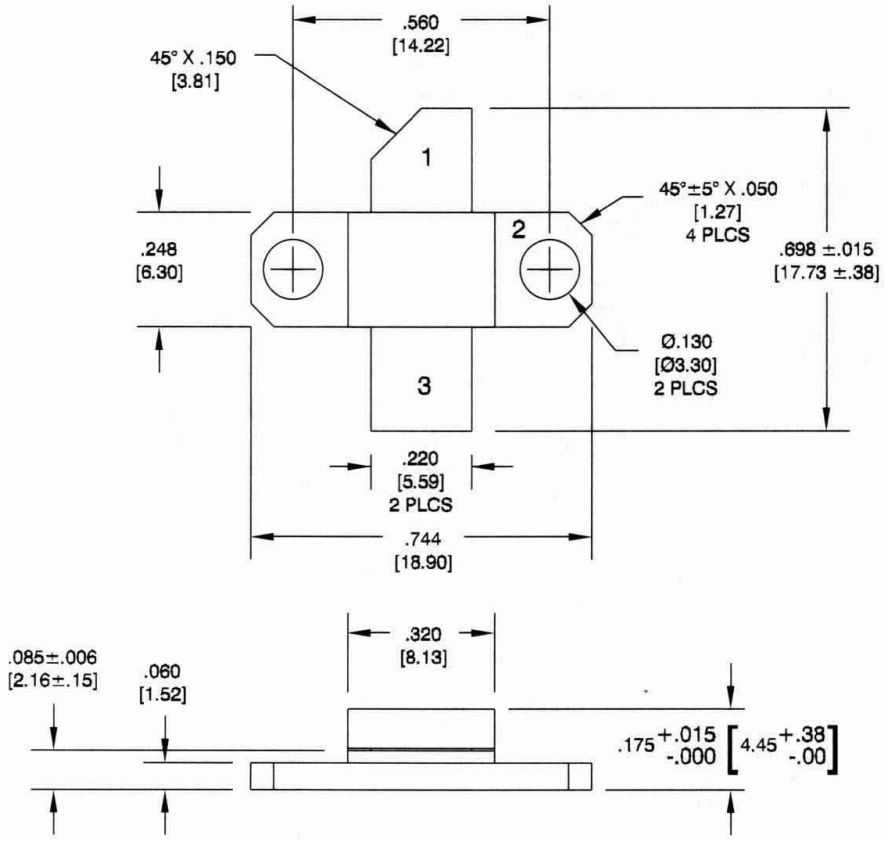
Pin CE: 1.Collector 2.Base 3.4.5.6.Emitter
Pin CB: 1.Collector 2.Emitter 3.4.5.6.Base
Lead Thickness: 0.005±0.001" [0.13±0.03mm]

ERICSSON

Unless otherwise noted, lids are toleranced with reference to the leads.

Primary dimensions are inches; alternate dimensions are mm.

Package 20209



Unless otherwise specified
all tolerance ±0.005" [0.13mm]

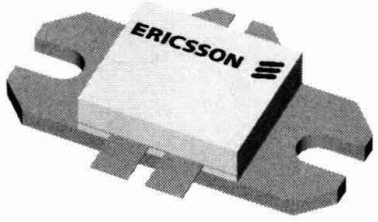
Pin CE: 1.Collector 2.Emitter 3.Base
Pin CB: 1.Collector 2.Base 3.Emitter
Lead Thickness: 0.005±0.001" [0.13±0.03mm]

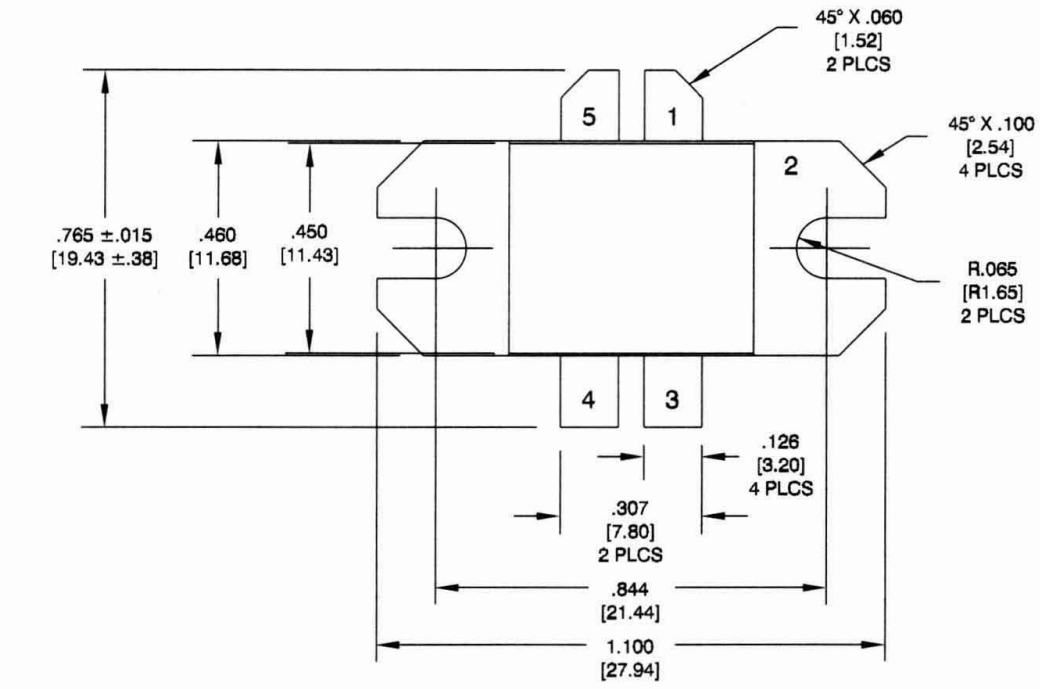
ERICSSON

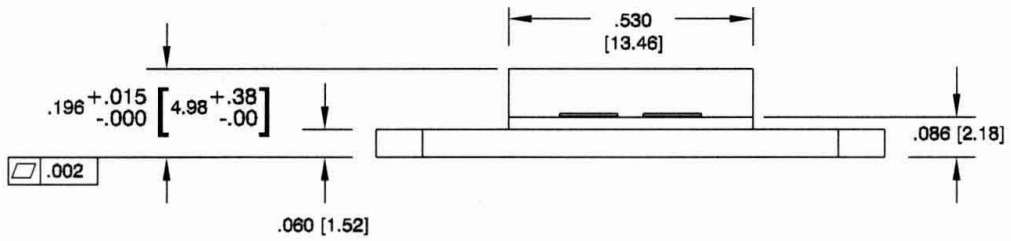
Unless otherwise noted, lids are toleranced with reference to the leads.

Primary dimensions are inches; alternate dimensions are mm.

Package 20212







Unless Otherwise Specified
all tolerance ±0.005" [0.13mm]

Pin CE: 1.5.Collector 2.Emitter 3.4.Base
Pin CB: 1.5.Collector 2.Base 3.4.Emitter
Lead Thickness: 0.003±0.001" [0.08±0.03mm]

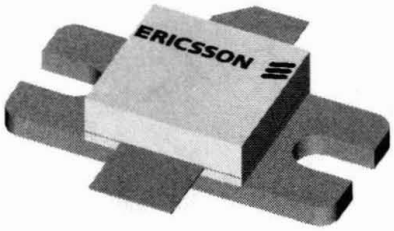
4

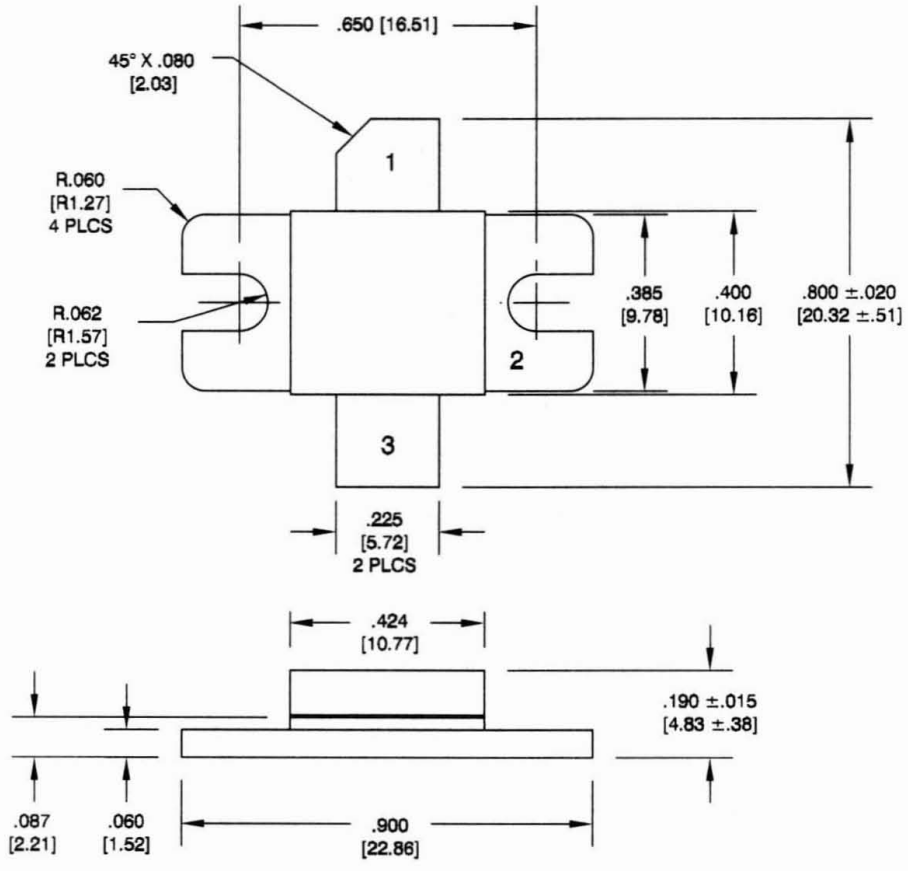
ERICSSON

Unless otherwise noted, lids are toleranced with reference to the leads.

Primary dimensions are inches; alternate dimensions are mm.

Package 20216





Unless Otherwise Specified
all tolerance ±0.005" [0.13mm]

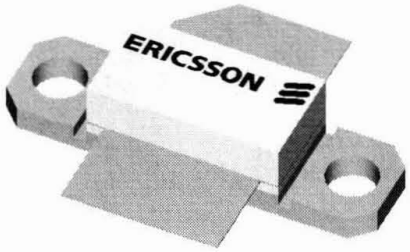
Pin CE: 1.Collector 2.Emitter 3.Base
Pin CB: 1.Collector 2.Base 3.Emitter
Lead Thickness: 0.005±0.001" [0.13±0.03mm]

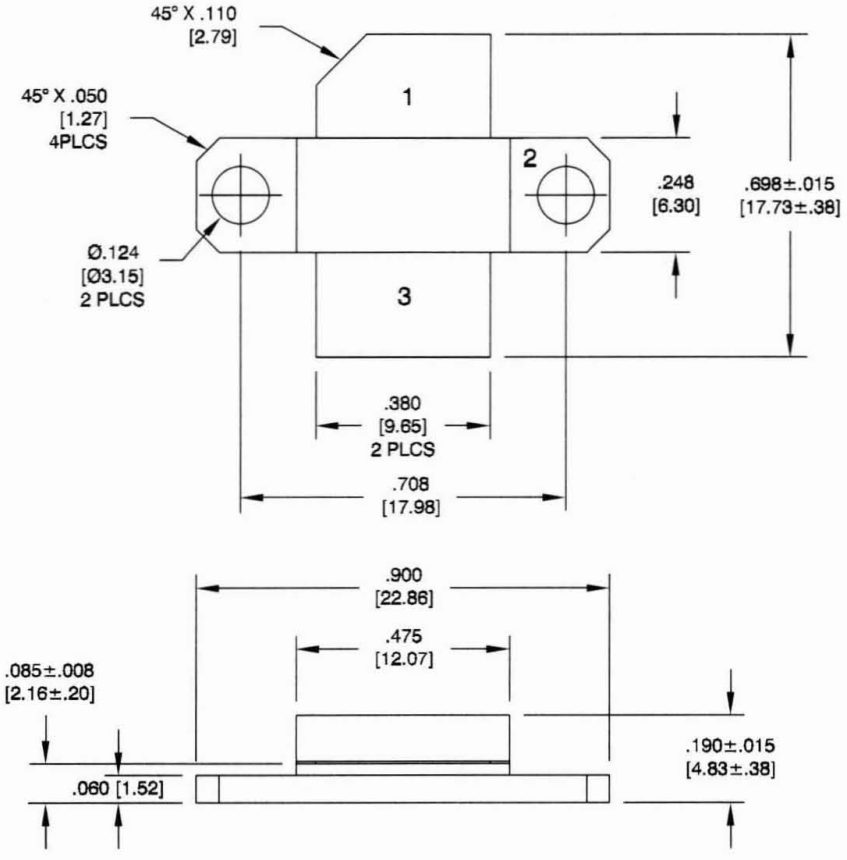
ERICSSON

Unless otherwise noted, lids are toleranced with reference to the leads.

Primary dimensions are inches; alternate dimensions are mm.

Package 20223





Unless otherwise specified
all tolerance ±0.005" [0.13mm]

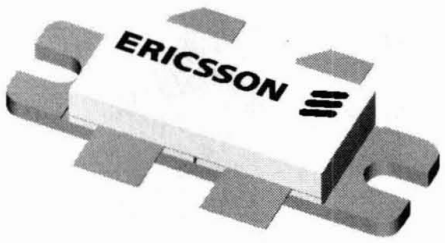
Pin CE: 1.Collector 2.Emitter 3.Base
Pin CB: 1.Collector 2.Base 3.Emitter
Lead Thickness: 0.005+0.001/-0.002"
[0.13 +0.03/-0.05mm]

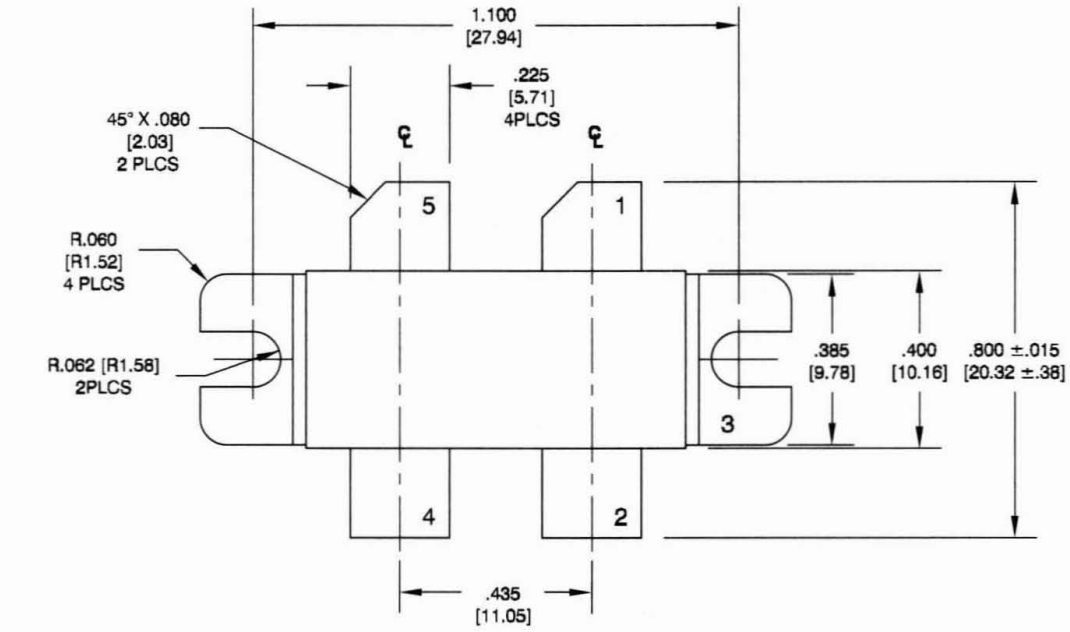
ERICSSON

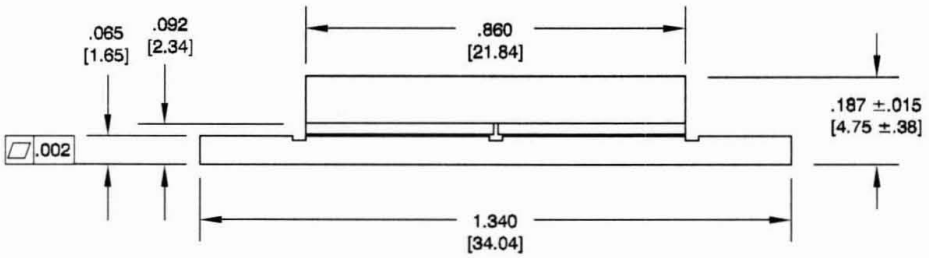
Unless otherwise noted, lids are toleranced with reference to the leads.

Primary dimensions are inches; alternate dimensions are mm.

Package 20224







Unless Otherwise Specified
all tolerance ±0.005" [0.13mm]

Pin CE: 1.5.Collector 2.4.Base 3.Emitter
Pin CB: 1.5.Collector 3.Base 2.4.Emitter
Lead Thickness: 0.005±0.001" [0.13±0.03mm]

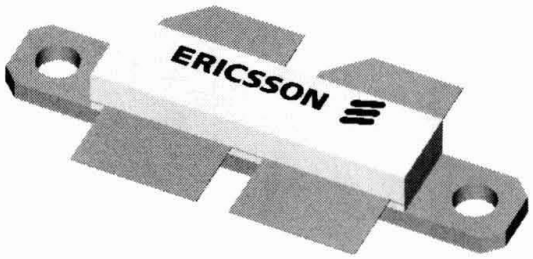
4

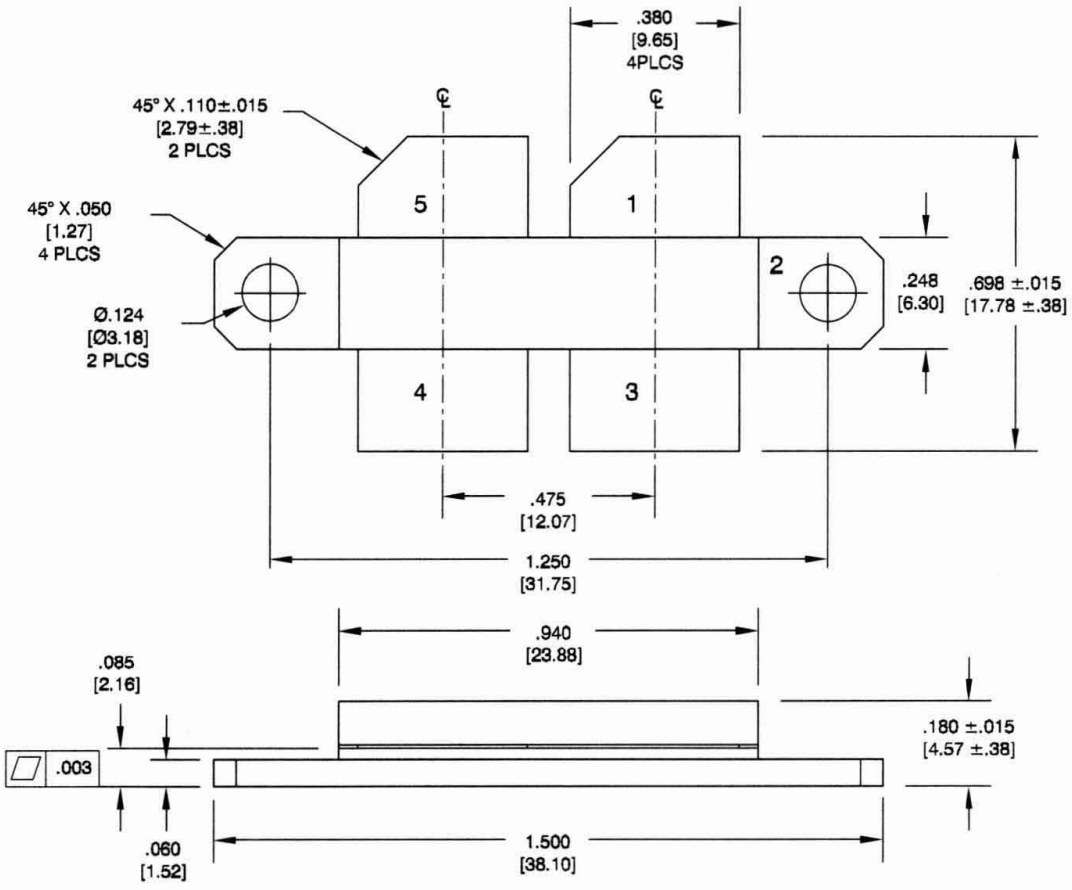
ERICSSON

Unless otherwise noted, lids are toleranced with reference to the leads.

Primary dimensions are inches; alternate dimensions are mm.

Package 20225





Unless Otherwise Specified
all tolerance ±0.005" [0.13mm]

Pin CE: 1.5.Collector 2.Emitter 3.4.Base
Pin CB: 1.5.Collector 2.Base 3.4.Emitter
Lead Thickness: 0.005±0.001" [0.13±0.03mm]

4

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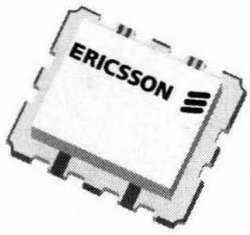
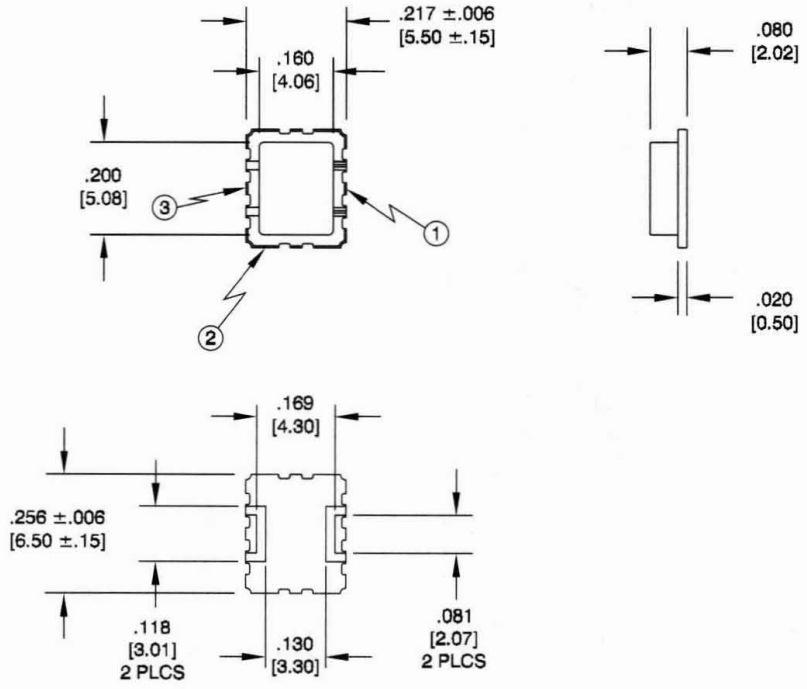
Unless otherwise noted, lids are toleranced with reference to the leads.

Primary dimensions are inches; alternate dimensions are mm.

Package 20227





Unless Otherwise Specified
all tolerance ±0.005" [0.13mm]

Pin CE: 1.Collector 2.Emitter 3.Base
Pin CB: 1.Collector 2.Base 3.Emitter
Thickness Tolerance: ±0.002"[0.05mm]

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Primary dimensions are inches; alternate dimensions are mm.

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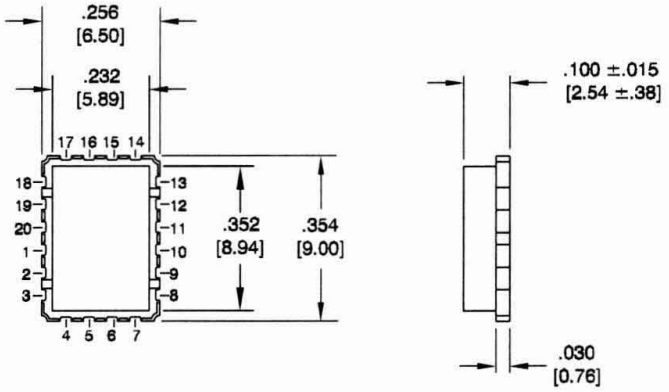

Bottom Side
Contact Area

Unless Otherwise Specified
all tolerance ±0.005" [0.03mm]

Pins:
Collector: 1,2,19,20
Base: 9,10,11,12
Emitter: 3,4,5,6,7,8,13,14,15,16,18

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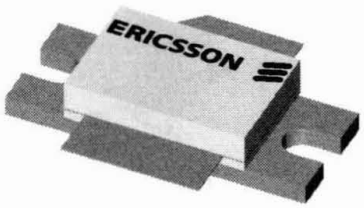
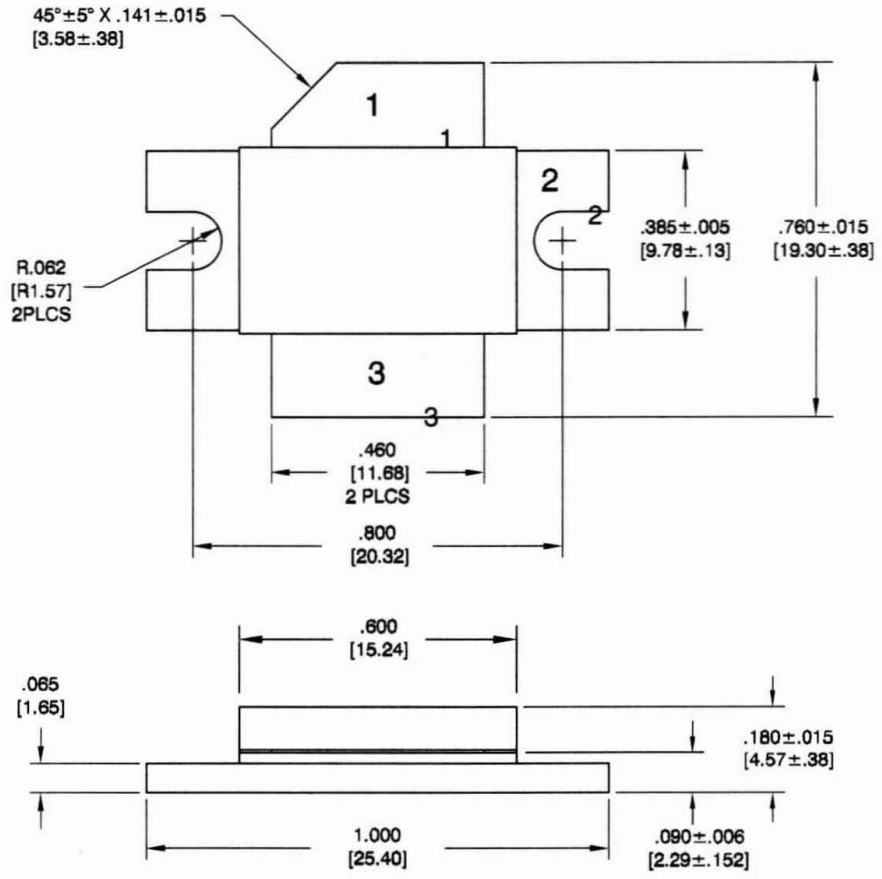
Unless otherwise noted, lids are toleranced with reference to the leads.

Primary dimensions are inches; alternate dimensions are mm.

Package 20234





All tolerance ±0.005"
Unless specified

Pin CE: 1.Collector 2.Emitter 3.Base
Pin CB: 1.Collector 2.Base 3.Emitter
Lead Thickness: 0.005 ±0.001"

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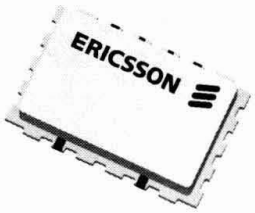
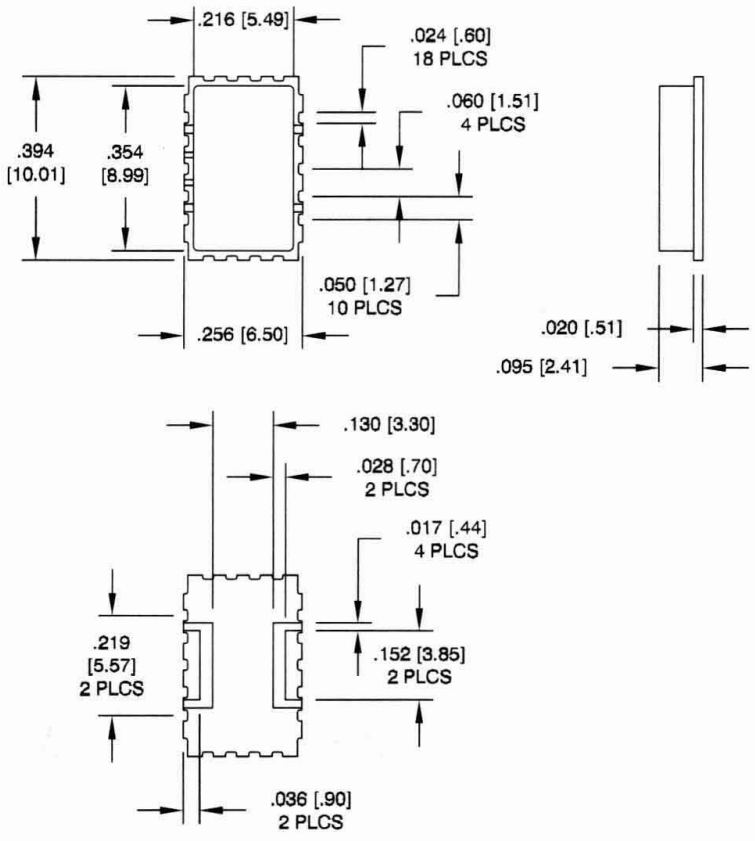
Unless otherwise noted, lids are toleranced with reference to the leads.

Primary dimensions are inches; alternate dimensions are mm.

Package 20243





Unless otherwise specified
all tolerance ±0.005 [0.13mm]

Pins: 1,2,22 Collector
3,4,5,6,7,8,9,10,14,15,16,17,18,19,20,21 Emitter
11,12,13 Base

4

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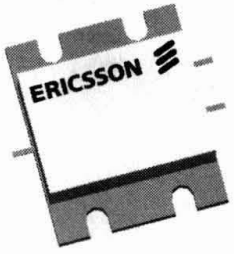

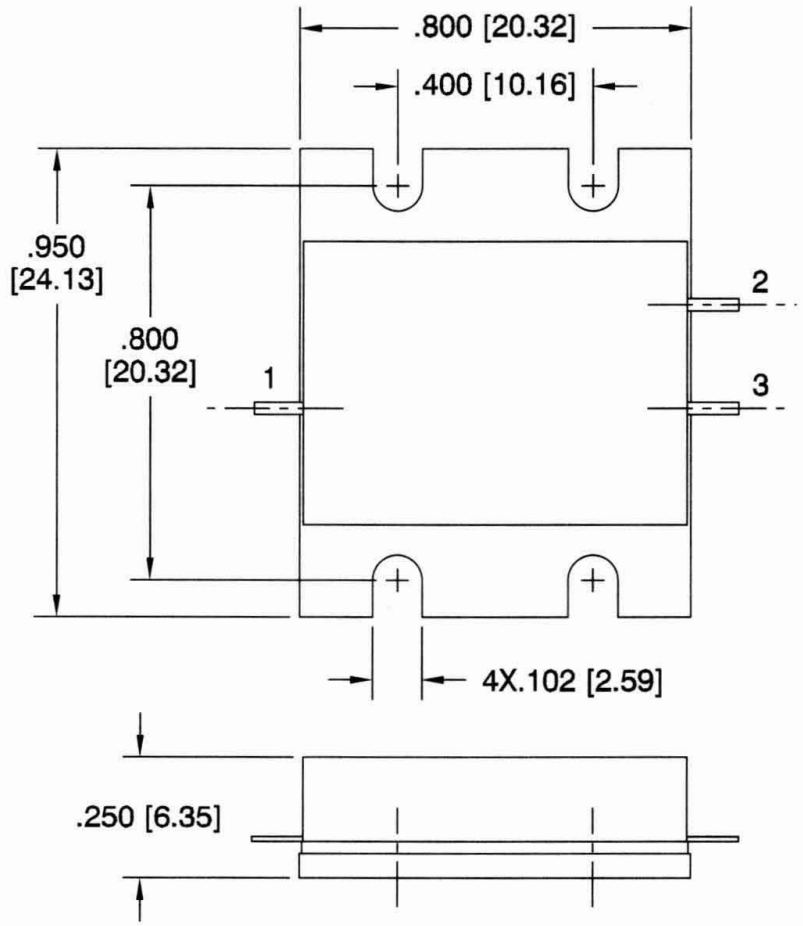

MECHANICAL
NOTE - DIMENSION MAY INCREASE BY .015/.025 FOR PRODUCTION

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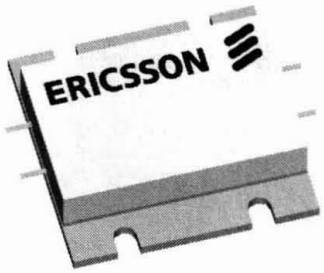
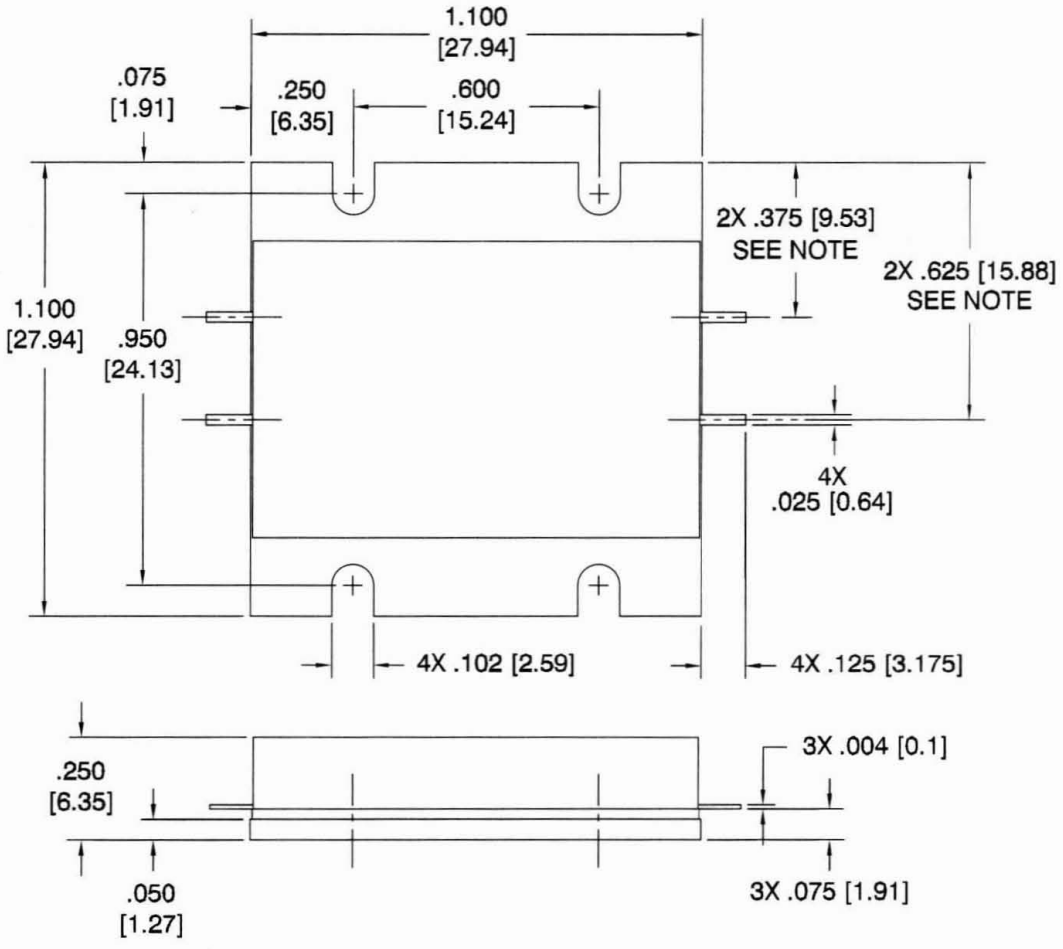
Unless otherwise noted, lids are toleranced with reference to the leads.

Primary dimensions are inches; alternate dimensions are mm.

HIT Package J





MECHANICAL
NOTE - DIMENSION MAY INCREASE BY .015/.025 FOR PRODUCTION

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Ericsson Components 20125, 100 Watts at 2 GHz!

Prepared by Cynthia Blair, Ericsson Components, RF Power Products

With the advent of PCS, demands for high power amplifiers working at 2 GHz have increased. Devices with larger peak power handling capability, along with a high degree of linearity, are needed for any application in this area (TDMA, CDMA, multicarrier).

Most high power PCS amplifiers currently being manufactured use multiple devices in parallel. If a single, larger device could be used the amplifier designer would have many advantages:

1. Combining losses would be reduced, raising system efficiency.

2. Circuit board real estate requirements would be significantly reduced.

3. Overall cost would be reduced with the elimination of combining networks, bias and support circuitry for the additional devices.

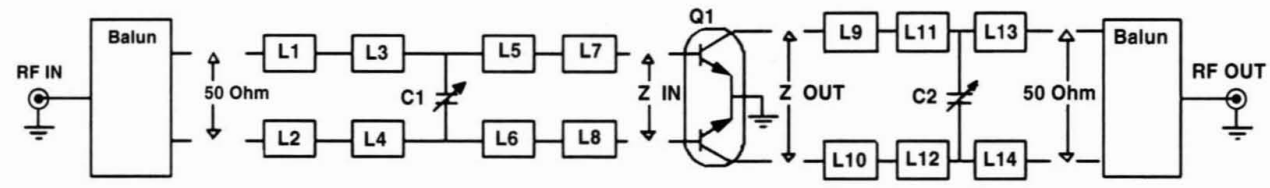
4. With careful design, cooling would not be a problem as the peak to average power ratios in these applications are typically very high.

5. MTTF will be increased as component count is reduced.

To achieve a single, significantly higher power device, one of the greatest obstacles to be overcome is transistor packaging. Ericsson's 20225 package style was developed with a very short front to back distance, combined with a very wide collector island and an enhanced grounding system. Several iterations were required, but devices which successfully used this new package went into production in September 1995.

In addition to the challenges packaging presented, it was determined a transistor die having a significantly larger active area while maintaining a low COB would be needed. Engineers at Ericsson's wafer fab in Kista-Stockholm Sweden, together with engineers in Morgan Hill, California, USA created a new die with excellent results. This die not only has very low capacitance, but when combined with the new packages had improved thermal spreading characteristics. Because of the high performance nature of this die, it was possible to give the device a high level of emitter ballasting to optimize linearity and still maintain a reasonable amount of gain. Armed with this new die the PTB 20170 (30 watts, 2 GHz) and the PTB 20175 (55 watts 2 GHz) were quickly developed. With the new package and the new die combined, the PTB 20125 at (100 watts, 2 GHz) was a milestone step in PCS device development.

The 20125 is rated for 100 watts PEP in the 1.9 to 2.0 GHz band, the typical



Q1 - PTB 20125 NPN PCN/PCS Power Transistor
C1,C2 - Johanson Piston Trimmer 0- 4 pF
L1,L2 - Microstrip 14.85Ω .067λ 2GHz
L3,L4,L7,L8 - Microstrip 11.7Ω .0217λ 2GHz
L5,L6 - Microstrip 8.15Ω .053λ 2GHz
L9,L10 - Microstrip 6.7Ω .055λ 2GHz
L11,L12 - Microstrip 11.45Ω .052λ 2GHz
L13,L14 - Microstrip 16.9Ω.060λ 2GHz

Figure 1. Matching networks.

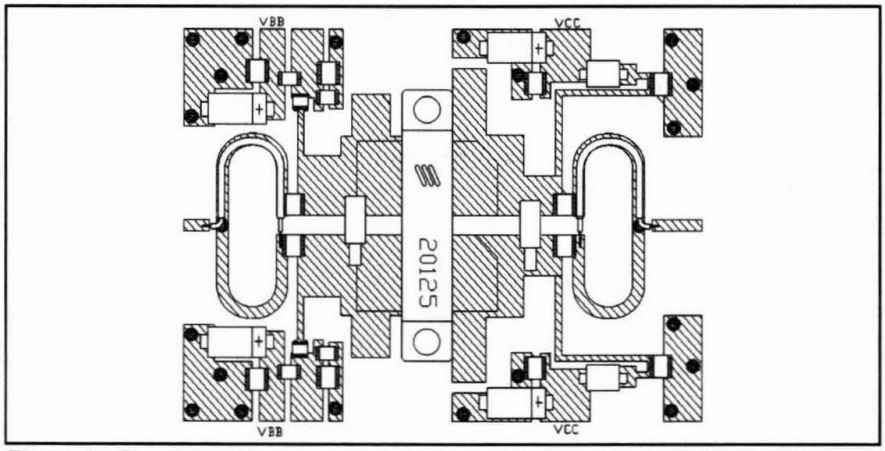


Figure 2. Circuit layout.

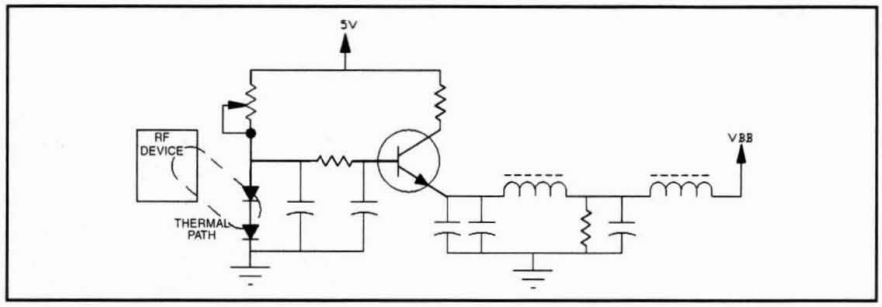


Figure 3. Base bias circuit with temperature compensation.

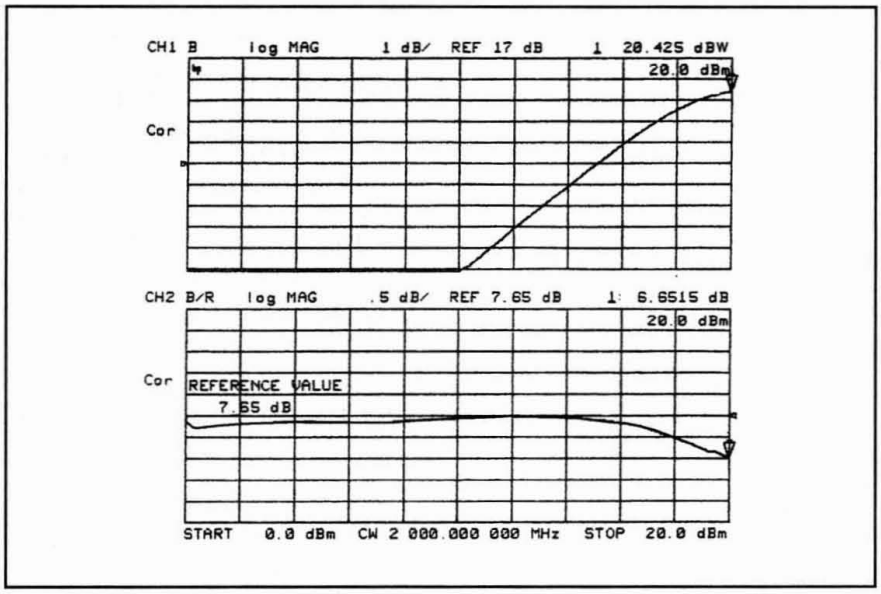

CH1 B log MAG 1 dB/ REF 17 dB 1 20.425 dBW
20.0 dBm
Cor
CH2 B/R log MAG .5 dB/ REF 7.65 dB 1: 6.6515 dB
20.0 dBm
Cor
REFERENCE VALUE
7.65 dB
START 0.0 dBm CW 2 000.000 000 MHz STOP 20.0 dBm

Figure 4. Gain vs. power out.

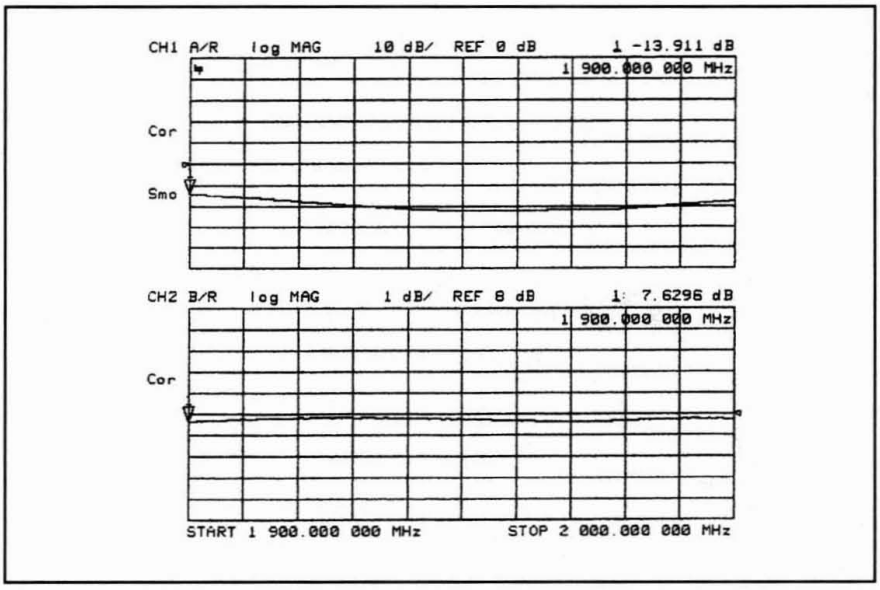

CH1 A/R log MAG 10 dB/ REF 0 dB 1 -13.911 dB
1 900.000 000 MHz
Cor
Smo
CH2 B/R log MAG 1 dB/ REF 8 dB 1: 7.6296 dB
1 900.000 000 MHz
Cor
START 1 900.000 000 MHz STOP 2 000.000 000 MHz

Figure 5. Return loss and gain vs. frequency.

power gain is 7.5 dB; it operates class AB with a V_{CC} of 26 volts, collector efficiency is typically 50% , typical 2-tone IMD is -35 dBc at 100 watts PEP. It draws heavily on the proven technologies in Ericsson PCS devices which have been produced in large quantities.

PTB 20125—100 Watt Amplifier Circuit

A test circuit was developed which utilizes a classic push-pull topology and operates class AB. 1:1 Baluns are used on the input and output. These transform the single ended input into 2 signals of equal amplitude 180° out of phase, and perform the opposite function in the output. Using the data from initial computer calculations, low pass matching networks were synthesized for the input and output. The resulting matching networks, after computer optimization, are shown in figure 1. Our application was optimized for 1.9 to 2.0 GHz. Owing to the high frequency and the internal device matching we found this bandwidth quite easy to achieve. Standard decoupling networks were used on the base and collector DC feedlines.

The resulting circuit was fabricated on .031 thick, er = 4.0 material, shown in figure 2 (not scaled).

Bias thermal compensation

When biasing a device of this nature for linear operation care must be taken to insure that the bias supply has enough current capability to maintain a constant operating point over large peak swings. It should also be thermally linked to the RF device it is supporting. This will help to maintain linearity over a wide temperature range. In figure 3 a circuit is shown with a very simple thermal feedback system.

Performance Measurements

The following series of figures illustrate the measured performance of the prototype unit.

In figure 4, the gain (lower display) is synchronized with power out (upper

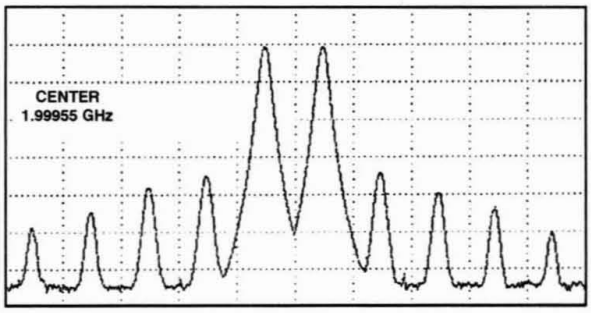


Figure 6. Scale is 10 dB per division.

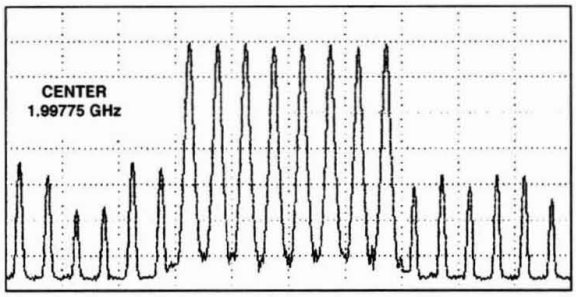


Figure 7. Scale is 10 dB per division.

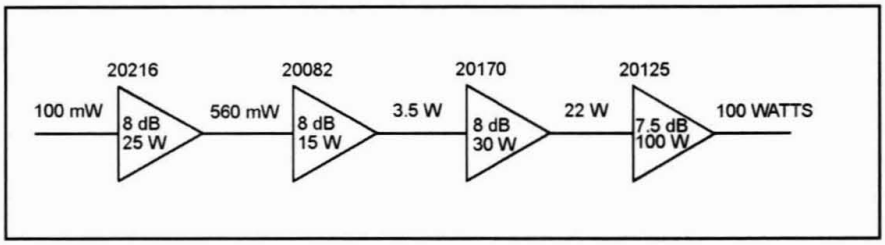


Figure 8. Suggested lineup.

display). On the gain display you can observe the 1 dB compression point at a power level of 20.425 dBW (110 watts).

In figure 5, the upper display shows return loss from 1.9 to 2.0 GHz, the lower display shows gain flatness across the same range.

Linearity

Two tone testing at the 100 watts PEP level on our amplifier yielded performance as shown in figure 6.

A series of 8 tone tests were run. For these tests the I_{CQ} was run at a higher level (500 mA @ 26 V) due to the lower average power levels. The average power for this test was 12.5 watts, this corresponds to 96 watts PEP. Eight-tone results from the prototype are shown in figure 7.

Ericsson Components offers a full range of RF power Transistors for the PCS/Cellular bands. Figure 8 shows a suggested lineup for a complete TDMA, PCS power solution from 100 milliwatts through 100 watts.

References

1. "Biasing Solid State Amplifiers to Linear Operation," Helge Granberg. RF Design, April 1991

2. *Solid Circuits*, ed. Joe Johnson. San Carlos, CA: Communications Transistor Company, 1973.

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FETs Address Linearity Challenge

Prepared by Scott Porro, Ericsson Components, RF Power Products

Introduction

The volume of cellular base station traffic is skyrocketing. Increasing traffic can only be handled by improving the linearity of the RF power amplifiers that are the nucleus of these base stations. Historically these power amplifiers operated in Class AB, which offered an acceptable balance between linearity and efficiency. However to achieve the desired increase in linearity, a bipolar transistor biased Class AB mandates that these amplifiers operate over specific output power levels, whereas a lateral FET offers more flexibility.

This article describes the device structure and electrical characteristics of the laterally-diffused metal-oxide-semiconductor (LDMOS) field-effect transistor, and then discusses how Ericsson RF Power Products has addressed the linearity challenge using the LDMOS FET.

Device Structure

A cross-sectional view of an LDMOS FET is illustrated in figure 1. The FET is a three terminal device and consists of a p-type semiconductor substrate into which two n-type regions, source and drain, are formed. The gate region is separated from the conducting channel by a thin layer of SiO_2 which is grown onto the channel. When a sufficiently large positive voltage is applied to the gate with respect to the source an inversion layer (or channel) is formed between the two n-type regions, the source and drain are then connected by a conducting surface n-channel through which current can flow. The LDMOS FET operates in the *enhancement-mode*, that is, with a positive-polarity drain voltage applied, no drain current flows until a positive gate voltage "enhances" a channel across the p well. In operation, the channel current is modulated by the ac signal impressed upon the gate.

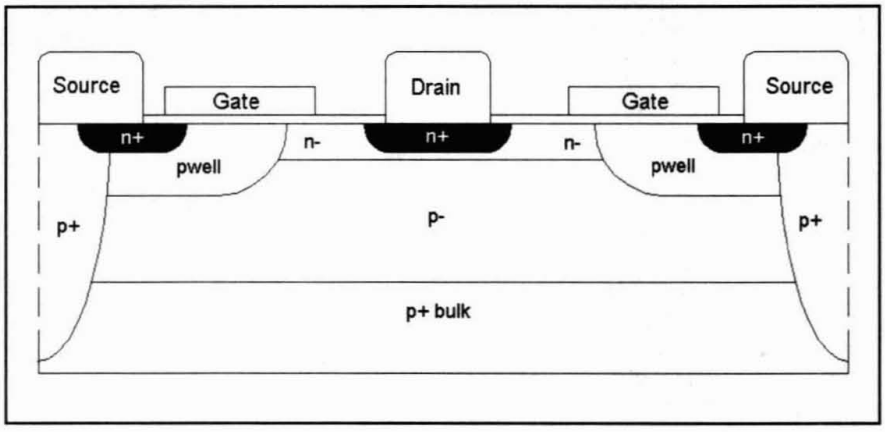

Figure 1. Simple diagram of a power LDMOS field effect transistor.

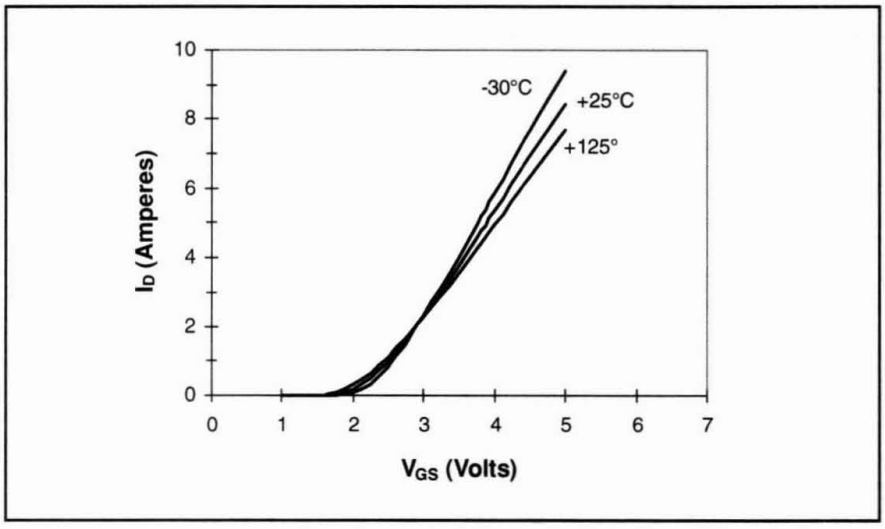

Figure 2. Drain current versus gate voltage over temperature. Data show typical current variations for Ericsson's PTF-10004.

The source is brought to the bottom side of the die in order to lower source inductance and to improve the intrinsic gain. The die can also be attached directly to the flange of a transistor package thereby reducing thermal resistance. Gold metallization and silicon nitride passivation are incorporated to insure excellent device lifetime and reliability.

Electrical Characteristics

DC Bias

Channel current in an enhancement-mode MOSFET is controlled by a voltage applied to the gate electrode. By virtue of the isolated gate electrode, and, no forward biased p-n junctions as we have with all bipolar transistors, the gate draws no current. The resulting high input impedance allows for a DC bias network to be a resistive divider to provide for proper bias. This reduces circuit complexity and cost compared to an active low impedance network required to bias the emitter base junction of a BJT.

Thermal Stability

Another advantage of the MOSFET as compared to the bipolar transistor is its thermal stability. Drain current in the saturation region of the current-voltage

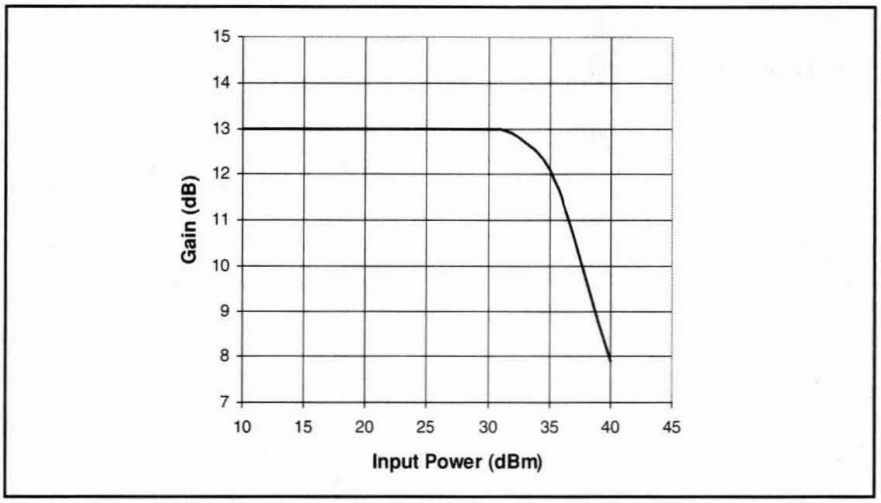

Figure 3. Gain versus input power of the PTF-10004

characteristics is given by:

$$I_D = k(V_{GS} - V_T)^2$$

where k is a scale factor and $k\alpha\ T^{-3/2}$ and V_T is the threshold voltage

The scale factor depends on the geometry of the FET, gate oxide capacitance, and carrier mobility. Since the scale factor has a negative temperature coefficient, this causes the drain current to decrease with increasing temperature. The threshold voltage is also temperature dependent, however under large drain currents the combined effect produces a drain current that is inversely proportional to temperature resulting in complete absence of thermal runaway.

The drain current versus gate voltage of Ericsson's PTF-10004 LDMOS device over temperature is shown in figure 2.

RF Gain

The LDMOS FET process has significantly improved RF performance by virtue of lowering the drain to gate capacitance (Crss). This not only improves gain but also results in better device stability. In addition, having the source on the bottom of the die eliminates source inductance due to bond wires, which are required on vertical MOSFET structures. Source inductance acts as a degenerative feedback, lowering RF gain. Comparing a BJT with similar power capability, LDMOS transistors offer 3 dB gain improvement.

A plot of gain versus input power for the Ericsson PTF-10004 biased class AB is shown in figure 3. The bias current is optimized to achieve a maximally flat gain response. As the graph shows, the gain stays constant from a very low input power to the input level at which the device begins to compress. These characteristics can be an advantage in multichannel systems where high peak to average power ratios and low phase distortion are required.

Intermodulation Distortion

A comparison of two tone third order intermodulation distortion between the FET and BJT is shown in figure 4. The BJT has an optimum intermodulation performance near its rated power (45 Watts PEP) and gets worse as output power is varied above and below this level. The FET exhibits worse intermodulation at the upper end of its power rating but surpasses the BJT below 30 watts PEP. As the graph below shows, the LDMOS transistor intermodulation distortion has a monotonic slope with output power.

Figures 5, 6, and 7 show the spectrum of an 8 tone measurement taken on the PTF-10004. The measurements were taken at 50, 25, and 5 watts output peak envelope power (PEP) respectively. The graphs show that as the output power is decreased the intermodulation distortion products improve.

Summary

It has been shown that the LDMOS transistor offers improved gain performance, better thermal stability, and improved intermodulation distortion when output power is backed off as compared to the BJT. When biased at an optimum quiescent current, the gain of the FET can be held constant over a wide range of input power allowing use of a class AB stage where previously a class A stage was

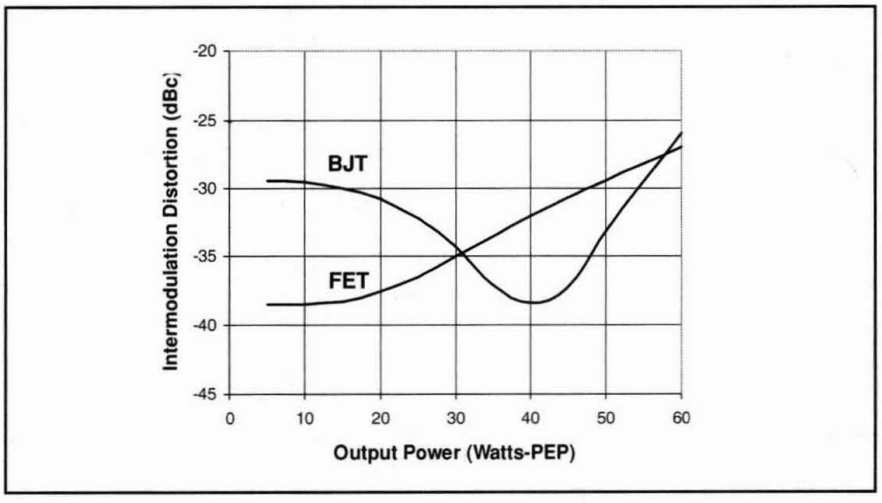

Figure 4. Third order intermodulation distortion versus output power for the FET and BJT.

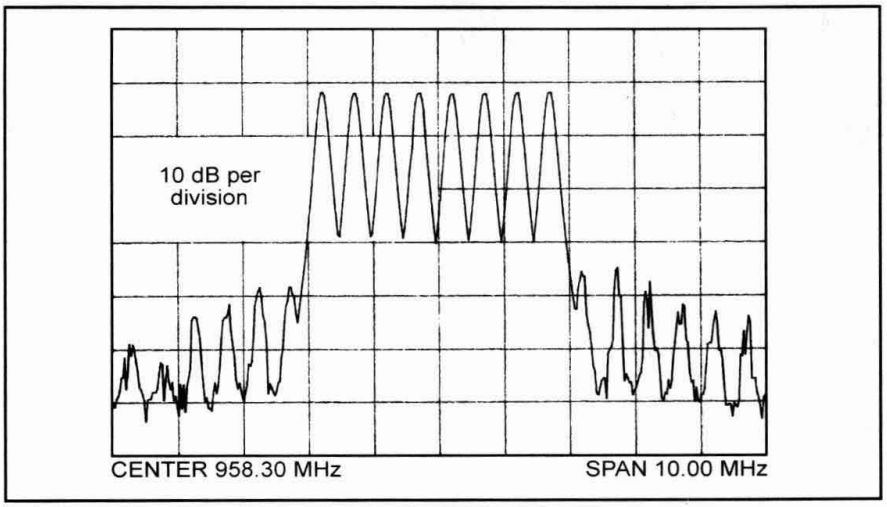

Figure 5. Spectral output of 8 tone test output power 50 Watts PEP.

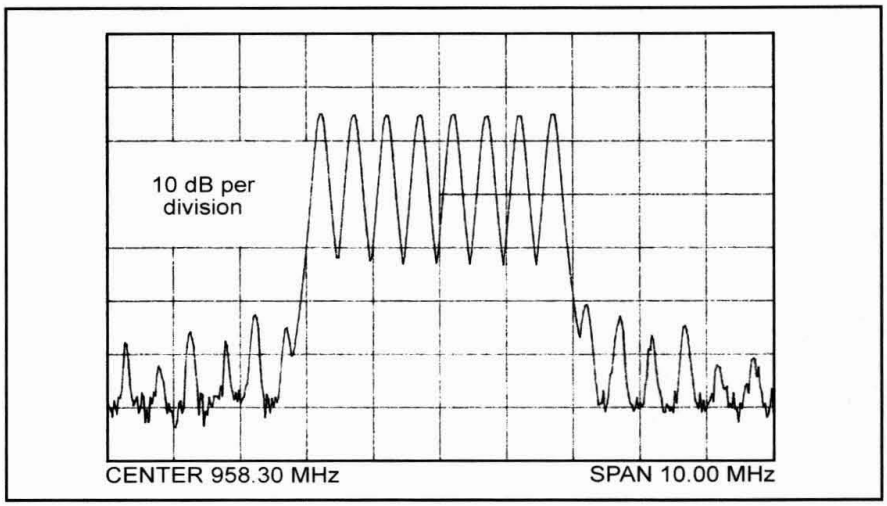

Figure 6. Spectral output of 8 tone test output power 25 Watts PEP.

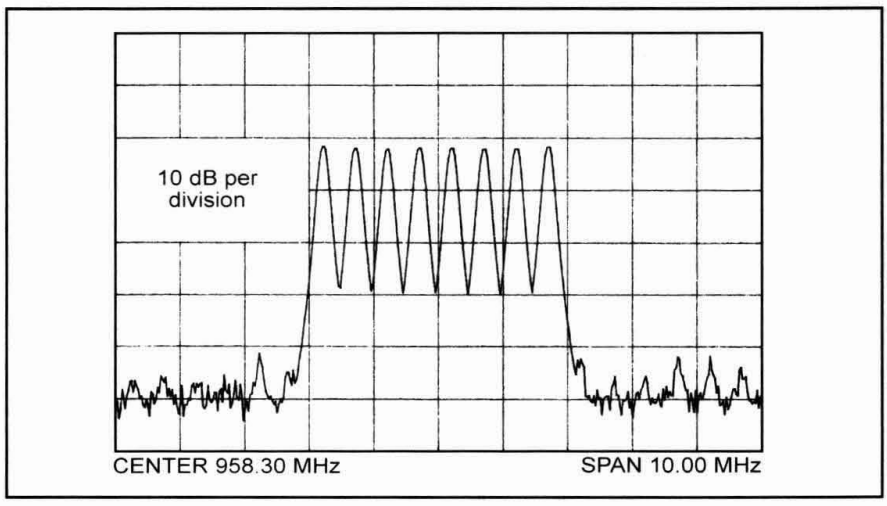

Figure 7. Spectral output of 8 tone test output power 5 Watts PEP.

required.

Ericsson RF Power Products is currently developing LDMOS transistors with power handling capabilities up to 130 watts to operate in both the 900 MHz and 2 GHz range.

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1. S. M. Sze, *Physics of Semiconductor Devices,* John Wiley & Sons, 1981.

2. P. Horowitz, W. Hill, *The Art of Electronics,* 2nd ed. Cambridge University, 1980, 1989.

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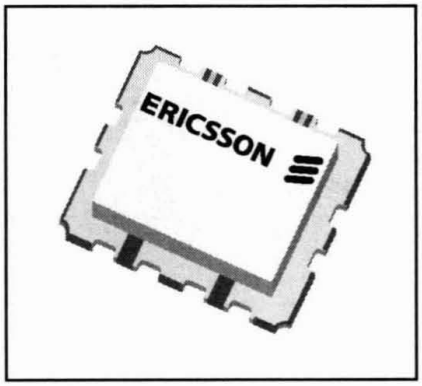
Mounting Information for Ericsson's Package 20227

Prepared by Henrik Sjöden, Ericsson Components, RF Power Products



Ericsson's Package 20227

As the 20227 package is intended for surface mounting, consideration must be taken to insure that the transistor operates sufficiently below it's maximum allowable chip temperature under all adverse conditions. The dissipated power is transferred in the form of heat from the device primarily by conduction through the printed circuit board (PCB) into the heat sink. Consequently, it is essential for the performance and reliability to ensure a low thermal resistance from junction to ambient. All materials and interfaces in the path of the heat flow should be considered. A proper mounting with plated through holes in the PCB for efficient heatsinking is illustrated in figure 2.

Footprint

The footprint for the transistor must be of sufficient size to ensure a proper solder connection between the package and the PCB. For good thermal performance of the transistor, the connection areas should be as large as possible, as illustrated in figure 3.

With the pad geometry proposed in figure 3, the package will self align when subjected to a solder reflow process. The recommended minimum thickness of the solder paste applied on the pads is 160 µm. If not enough solder paste is applied brittle Au-Sn intermetallics can arise in the solder connection and introduce cracks during power or thermal cycling.

Plated through-holes (thermal vias)

The main heat flow path is from the bottom of the transistor through the PCB into the heat sink. As the PCB is a poor thermal conductor it necessitates the use of plated through-holes (thermal vias) for the heat conduction. The size and the density of the thermal vias and PCB thickness are important parameters which will have an influence on the overall thermal resistance. The thickness of the PCB should be kept to a minimum to reduce the path for the heat flow in the vias.

The vias can be placed just under the device or over a larger area close to the transistor, depending on the required power level, or when an improved thermal performance is needed. As the number of vias are being increased and the pitch decreased a substantial reduction in thermal resistance junction to ambient can be achieved. Increasing the number of vias will also improve the RF performance of the transistor, since the device will have a better ground connection.

A good start for this package is a 0.5 mm via diameter and 1-1.5 mm pitch. If a large via diameter is used, solder can be drained and form bumps on the bottom side of the PCB causing insufficient thermal contact to the heat sink.

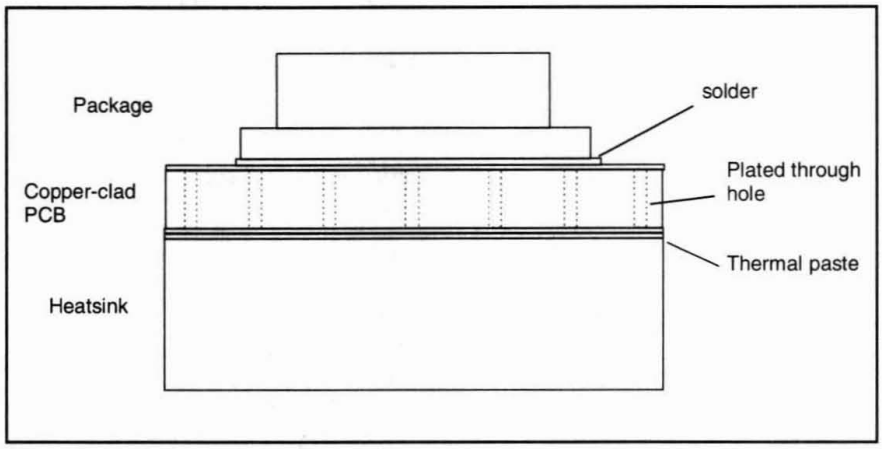


Figure 2. Package mounting.

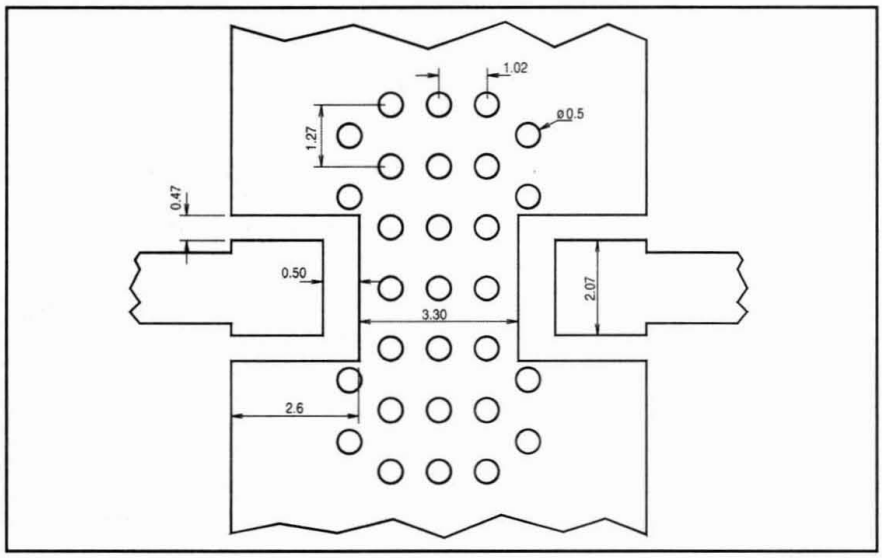


Figure 3. Example footprint for soldering (dimensions in mm).

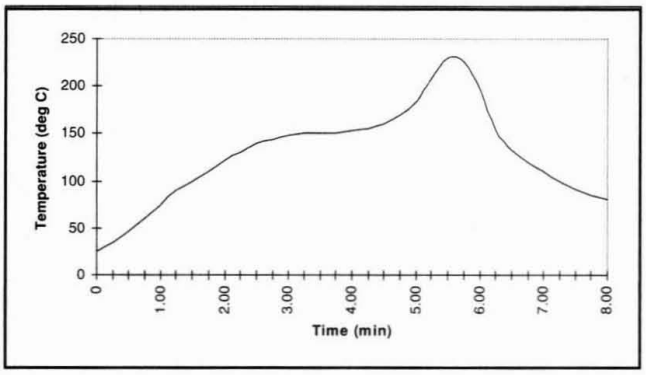


Figure 4. Typical solder heating profile.

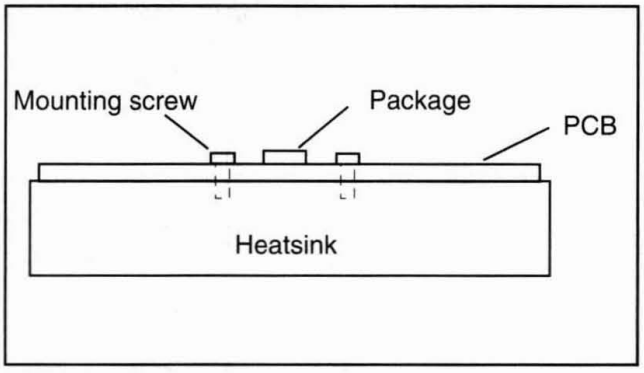


Figure 5. Recommended mounting screw locations.

An example of a via configuration and dimensions for footprint is shown in figure 3.

Reflow soldering

Reflow soldering is the preferred soldering technique for the 20227 package. A typical solder heating profile with the three characteristic heating stages, preheat, reflow and cooling is shown in figure 4.

As the temperature during the soldering process exceeds the rated temperature of the device, the time at this temperature should be kept to a minimum. The device must be preheated and cooled under controlled conditions as temperature gradients may introduce thermal stress resulting in eventual device failure. The temperature of the device must not exceed 260 °C for more than 10 seconds during the reflow process.

Replacement and hand soldering

Replacement of a device is most easily done with a special air gun intended for hand soldering of surface mount components. When the package is heated to soldering temperature it should be handled carefully as the glue that joins the lid and substrate might be soft. If the package is held by the lid the bond wires inside the device might be damaged or the lid and the substrate separated. Accordingly, when the package is removed it should be held by the AlN substrate.

The remaining solder on the PCB connection pads should be removed before new solder paste is applied. The new transistor can then be positioned on the PCB and heated until a good solder connection is formed.

PCB mounting

A critical interface is between the board and the heat sink. Regardless how well prepared the two surfaces are, air gaps will inevitably occur resulting in inadequate contact. The overall thermal efficiency of our assembly demands low thermal resistance from the 20227 package to the heat sink. Therefore, two steps should be followed. First, put a thin coating of thermal paste between the PCB and the heat sink; second fasten the PCB with a pair of screws as close as practical to the package as illustrated in figure 5. However, the layer of thermal paste must be kept very thin since excessive paste just will increase the thermal resistance.

The mounting screws will not only improve the thermal contact between the PCB and heat sink but also work as thermal vias transferring the heat from the top side of the PCB to the heat sink.

Another possibility is to glue the PCB to the heat sink using a thermal conductive glue.

This will reduce the problem with planarity of the surfaces and ensure a good thermal contact between board and heat sink. However, a possible replacement of the PCB will be complicated.

To further improve the thermal performance of the transistor the copper layers on each side of the PCB can be increased in thickness in order to spread the heat horizontally on a larger area. A final copper thickness of 70 µm on both sides of the board is preferred for high power applications.

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Inside the RF Power Transistor

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Introduction

The purpose of this application note is to show some of the chip level design considerations and technical details for Ericsson's bipolar RF Power transistors. Whether you are an amplifier designer, applications engineer, technical manager or just generally interested, these devices often appear to contain quite a lot of magic inside, and can require even more magic to use! This is partially true, if we define magic as something that is not easily calculated, or in these days, simulated on a computer.

The bipolar RF power transistors are among the oldest silicon devices. High-frequency transistors were first fabricated in germanium in the late 1950s but were soon replaced by silicon bipolar transistors at the beginning of the 1960s and have since then dominated the RF-power area. In 1971, H. F. Cooke described the theory and design of these transistors in an often-cited paper [1]. Much of his text is still applicable on today's devices. For cellular radio, the bipolar transistors are totally dominating and can deliver great performance up to and beyond 2 GHz with good stability, availability and price.

Cooke wrote in his article: "Not only are they difficult to build, but most of the more desirable parameters have been optimized." He was right about the difficulties in building the devices, but luckily, he was wrong about the optimization! Detailed knowledge in semiconductor device physics, device fabrication, RF & microwave theory and practice, and a lot of hands-on work are required, but it is still possible to improve performance, more than 25 years after Cooke's statement.

The improvements have mostly come from advances in the process and fabrication techniques. Progress in CMOS IC technology, photolithography, dry etching, metallization techniques for III-V technology, process and yield control has been utilized. The RF power transistors are now fabricated using 4" or 6" wafers with very high yield. Computer tools are available for process and device simulations. For accurately predicting the RF large signal performance, the tools still need to be improved, particularly when considering a complete packaged device with bond wire geometry and internal matching capacitors.

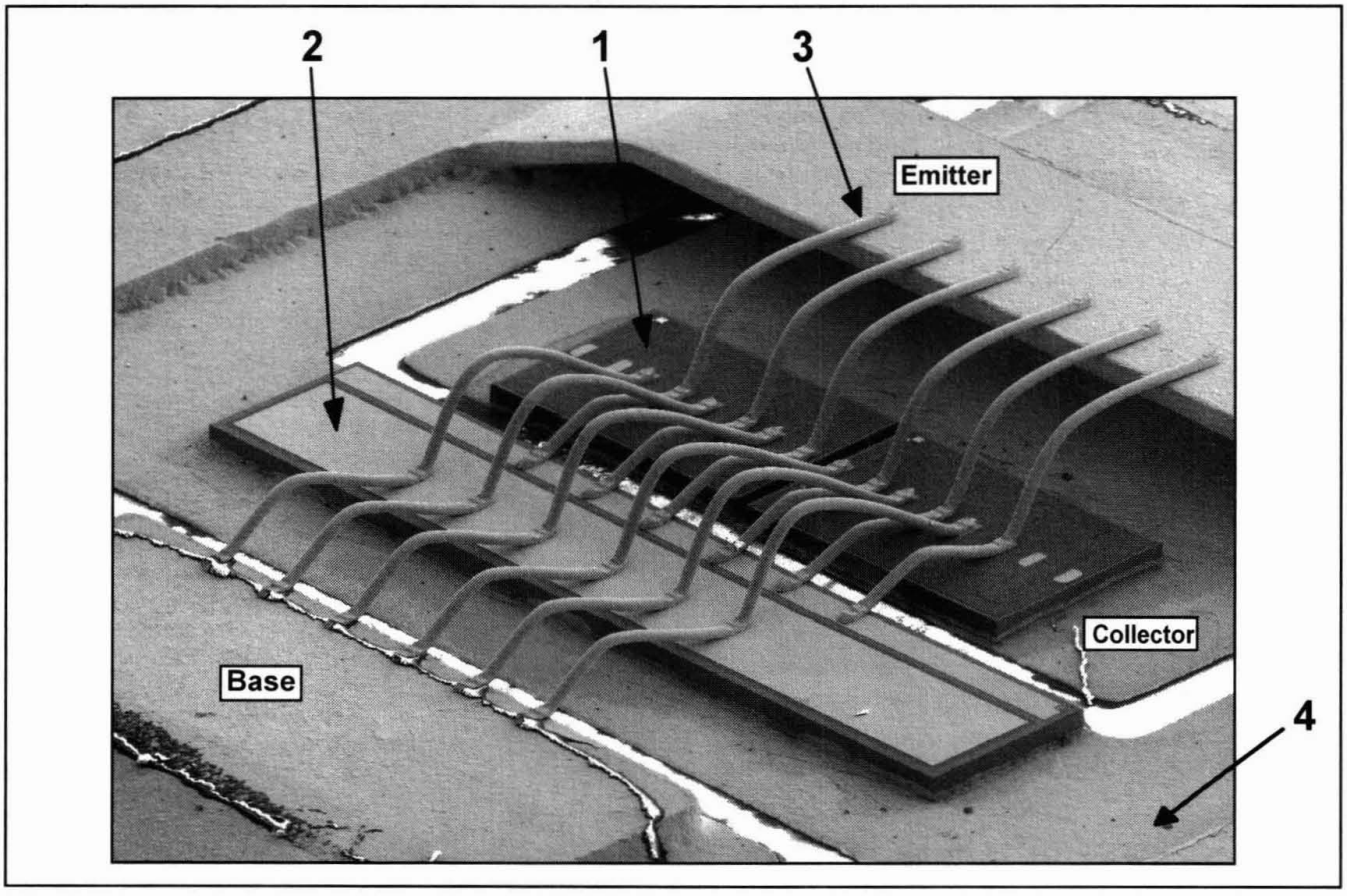

Figure 1. Inside Ericsson's PTB 20105 bipolar RF power transistor.

RF power devices have not been paid much attention to from the scientific/ academic point of view since the 1970s, except for the advances in III-V power device technology. Considering the evaluation of computing power, simulations tools and process technology, and the broad commercial interest, RF power has now a great research potential for the study of new structures, thermal behavior, linearity, bonding and matching, packaging and amplifier design.

Today, we are not close to any fundamental limits for the RF power devices. They will continue to evolve as the high-volume applications in the telecommunication area continue to go to higher frequency bands. There is potential to further improve the silicon for power applications in the 2 to 3 GHz range. The excellent price/performance, stability and availability of the silicon RF power devices will guarantee continued growth in the wire-less area.

Inside the package

To illustrate some device considerations for 1 to 2 GHz device technology, let us take a closer look at what is actually inside a transistor package!

Figure 1 shows an open transistor, the PTB 20105 (925-960 MHz, 20 W transistor, typical gain of 10 dB) as seen by Scanning Electron Microscopy, SEM. The magnification is 27 times.

The following parts can easily be identified:

(1) The silicon chips.

In this particular transistor, two transistor chips (1.4 x 0.9 mm, 55 x 35 mils), containing 4 transistor cells each, are used in parallel (actually only 3+3 transistor cells are connected). The chips are mounted very precisely, close to the edge of the metallization area, to minimize critical bond wire lengths, and to ensure the uniformity of the electrical characteristics.

The silicon chips have been lapped to a thickness of around 120 µm (<5 mils) from its initial thickness of 525 µm (21 mils) to lower the thermal resistance to the package.

The design considerations for making a good transistor at the chip level are discussed in the next sections.

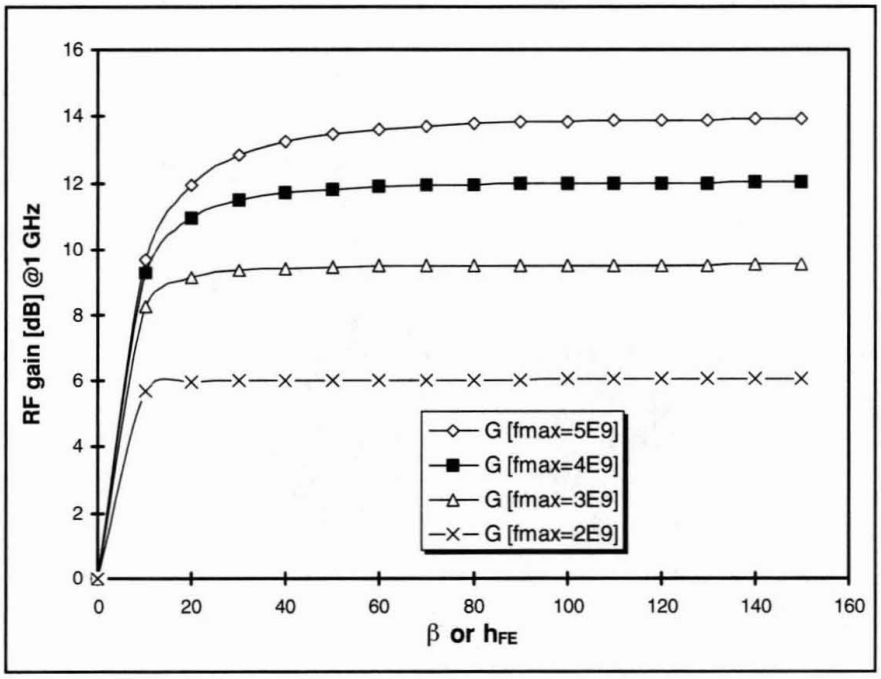

Figure 2. The RF gain at 1 GHz as a function of the DC gain (h_{FE}) and f_{max}.

(2) The chip capacitors for internal matching.

An input chip capacitor is connected to the input side (base), while no output matching was necessary for this device. A highly doped (n+) silicon is used for the chip capacitor, which is of MIM (metal-insulator-metal) type, with one "metal" being the highly doped substrate silicon and the other metal being a similar gold metallization as used on the transistor chips. The insulator is silicon dioxide or silicon dioxide + silicon nitride.

The chip capacitor has also been lapped to 120 µm, same height as the transistor chips, to ease the bonding.

(3) The bond wires.

The emitter wires go to a "bridge" that is connected to the emitter flange of the transistor package and the socket. In the other direction, the wires are connected to the substrate contact (grounded) on the chip capacitor.

The base wires first land on the capacitor and are then bonded to the base flange of the package.

The geometry of the bond wires is very critical to the device performance and bonding has to be done with great precision and repeatability.

(4) The package.

The package is usually gold plated Cu/ W. Since the bipolar transistor chips have their collector (connected to the supply voltage) on the backside, steps must be taken to isolate the chip mounting area from the grounded package by using an isolating material, while providing a low thermal resistance through the package. Beryllium oxide (BeO) has the unique properties required and is used in most isolated packages today. (The BeO in figure 1 is visible as the reflecting areas ("water"), because, being non-conductive, it charges and reflects the electrons used as "light" in the SEM.)

Device considerations

During the device design, a number of

critical considerations have been made on the chip level.

A few of them will be discussed in this section.

Breakdown voltage, epi selection

The design of transistors intended for high power applications follows a different path than transistors for small signal analog or digital circuits with supply voltages of 5 V, 3.6 V or lower. A high collector-base breakdown voltage (BV_{CBO}) is desired, because the devices need to be operated at high supply voltage (26 V) to achieve high output power. Furthermore, a switching transistor's collector side experiences up to two times the supply voltage during large-signal operation with inductive load. To support this high voltage, the collector epitaxial region (epi) must be thick, typically 6 to 8 µm, to avoid reach-through type of breakdown, and have a resistivity value (doping level) typically in the 1 to 2 Ωcm range, set by the avalanche breakdown of the junction.

The final selection of epi thickness and resistivity also affects base push out or Kirk effect (higher doping gives higher saturated output power), gain (collector-base capacitance), high frequency characteristics (f_T), resistive power loss ($P_{loss} = IR^2$), ballasting (see ballasting section, below), and linearity of the device.

Because of junction curvature, the theoretical breakdown voltage of the collector-base junction cannot be reached. However, by careful geometrical layout and the use of collector depletion rings or graded diffusions at the device edges, the sharp peaks of the electrical field can be reduced and breakdown voltage raised near its theoretical limit.

An empirical formula for the relationship of breakdown voltages in the transistor and current gain, β or h_{FE}, states [2]:

$$BV_{CEO} = \frac{BV_{CBO}}{\sqrt[n]{\beta}}$$

where BV_{CEO} is the collector-emitter breakdown voltage with open base, BV_{CBO} is the collector-base breakdown voltage with open emitter, and n is an empirical constant, usually between 2.5 and 4.5, related to the nature of the BC-junction breakdown.

This formula shows that for a given epi doping and device design (constant n), BV_{CEO} and β are directly correlated: higher β gives lower BV_{CEO}. If n can be improved, by different doping profile tricks or other means, BV_{CEO} can be increased for a given epi resistivity and β.

Data sheets often specify BV_{CER} instead of BV_{CEO}. A small resistor is then connected between the base and emitter. If the resistor is small enough, BV_{CER} will approach BV_{CES}, which is close to BV_{CBO}.

High frequency power gain

The power gain is usually the parameter most limited by the frequency, since the devices normally are operated at the frequency limited portion of the characteristics with a (theoretical) 10 dB/decade degradation.

The gain at RF can be described by the following relationship [3]:

$$G(f) \approx \frac{G_0}{\sqrt{1 + G_0^2 \left(\frac{f}{f_{max}} \right)^4}}$$

where G_0 is the zero-frequency gain (β or h_{FE}) and f_{max} is the maximum oscillation frequency, or the frequency where the power gain is equal to 1.

A plot of h_{FE} versus G is shown in figure 2 for different f_{max} values at f = 1 GHz. From this plot it can be concluded that a high f_{max} and a not too low β are detrimental for a good RF power gain. If β is higher than required for a constant RF gain, the device will be sensitive to parasitic oscillations, and will have a decreased BV_{CEO} (see previous section). High β also usually means high base resistance, which will lower the f_{max} (see below) and consequently the RF power gain.

An approximate expression for f_{max} is:

$$f_{max} \approx \sqrt{\frac{f_T}{8\pi R_b C_{bc}}}$$

where f_T is the transition frequency, or the frequency where the current gain is equal to 1, R_b is the base resistance and C_{bc} is the collector-base capacitance. f_T is a function of delay and charge times in the vertical C/B/E structure of the transistor. It is dominated by the base delay, which is proportional to the square of the base width.

High power gain at RF could be achieved by having a high f_T and a similar high f_{max}, but this is generally hard to accomplish, considering the delay times and the high supply voltage (the "Johnson limit"). In addition, a thin base (high f_T) means more base resistance

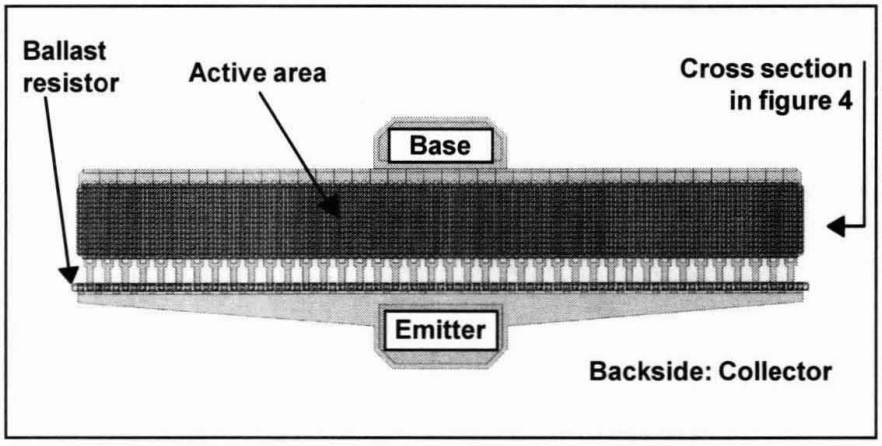

Figure 3. Interdigitated cell layout for RF power transistor.

(lower power gain) and/or higher β (decreased BV_{CEO}) and tighter process control.

Instead, devices are designed to have an f_T not very much higher than the operating frequency (1.5 to 2 times), and then f_{max} is maximized (R_b and C_{bc} minimized). f_{max}/f_T ratios of 2 to 3 can usually be obtained. As a comparison, f_{max}/f_T ratios for low-voltage high-frequency transistors are usually less than one.

Reducing the base resistance (higher base doping and lower parasitic resistances) and reducing collector-base capacitance (mostly by lower parasitics) is the secret to high power gain. R_b and C_{bc} are both influenced by vertical dimensions (doping profiles, isolation thickness) and lateral dimensions (layout). All major and minor contributions to these two parameters must be considered and actions taken to minimize them to achieve good RF gain.

Transistor layout for high gain and output power

Through the years, a number of layout concepts have been in use [1], but for cellular applications today, the interdigitated cell layout in figure 3 is totally dominating. For the common-emitter configuration, this layout offers the best performance with respect to RF gain, power/current distribution and area utilization.

The most critical parasitic capacitance for the gain is between collector and base. In a vertical RF power transistor, the silicon substrate is connected to the collector. The device area consists of a single diffused base tub, which area must be minimized for a given power requirement to obtain best possible gain.

The base metal also contributes to collector-base capacitance, and is therefore as narrow as possible. The emitter metal area, which must feed high currents, has been tapered toward the ends of the cell to save some additional collector-emitter capacitance.

The bond pads do not have square form; instead they are rectangular, similar to the "foot-print" of the bonding wire. To further reduce capacitance, the pad corners have been rounded.

The collector is connected to the backside of the chip, so only two types of bond pads, emitter and base, need to be bonded using wires.

By dividing larger cells into smaller units and spreading them over the silicon surface, the total thermal resistance can be lowered, but at the cost of increased interconnect metallization capacitance. In practice, the thermal improvements are moderate with spread-out layouts. Ericsson's high-power 2 GHz layouts use very large interdigitated cell layouts with several hundreds of parallel emitter fingers.

High output power is achieved by paralleling several cells on a chip and several chips in one package. In the PTB 20105 transistor in figure 1, each chip has four cells, and in total, two chips and six cells are used. The cells can be interconnected on the chip level to achieve better current balance and the chips connected by using inter-chip bond wires.

Emitter ballasting resistor, ruggedness

Also indicated in figure 3 is the *emitter ballast resistor.*

As the power increases in the transistor, the junction temperature also increases. If the current is not perfectly distributed over the active transistor area, *hot spots* will appear, which very quickly lead to thermal runaway and catastrophic failure. To ensure even current distribution, resistors are added in series with the emitter fingers. One resistor can be connected to an individual emitter finger or a small group of fingers. Any undesired increase in the current through a particular emitter or group of emitters will be limited by the resistor (effectively, V_{BE} will be decreased) [4]. This is called emitter ballasting and can be implemented as NiCr resistors, diffused resistors or polysilicon resistors.

Ericsson's transistors use diffused resistors, which are easy to fabricate and control. The resistor value can easily be optimized for different products by changing one implantation dose. Drawbacks are larger CE capacitance contribution compared to polysilicon resistors, and the risk of lower BV_{CES} values if the resistor doping profile is too shallow or too deep.

The most common cause of device failures are high current standing wave ratios (VSWR) which occur at high power levels during load mismatch. The resistance of the epitaxial silicon limits high currents and increases the device's ability to survive during load mismatch; the RUGGEDNESS is improved. The additional epi resistance is called collector ballasting. It increases the saturated V_{CE} and reduces the voltage swing over the collector.

Adding ballasting has one drawback—it lowers the output power or the gain. Which is the best method for increasing the ruggedness, emitter or collector ballasting? The high VSWR during load mismatch creates large temperature

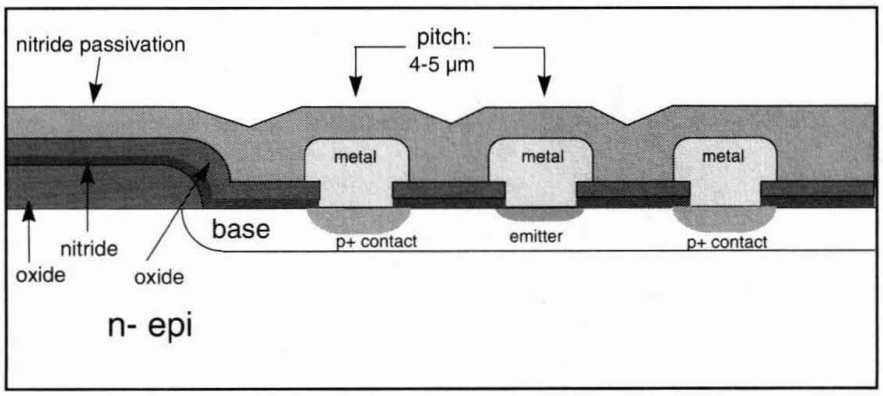

Figure 4. Cross-section of device structure for 1 GHz technology.

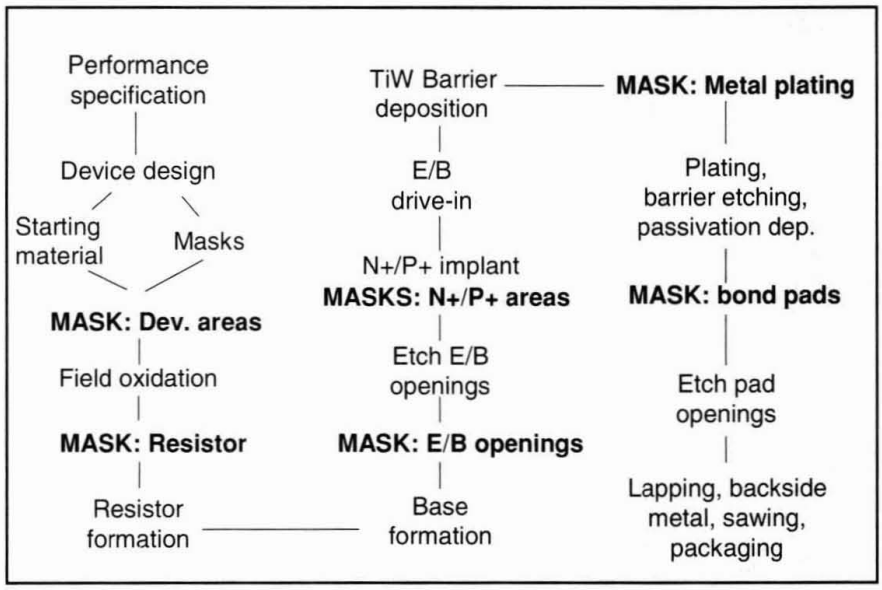

Figure 5. Basic design and process flow for a bipolar RF Power transistor.

variations. A general limitation of the collector current (collector ballasting) is less efficient to prevent the occurrence of hot spots leading to catastrophic failures. Therefore, the distributed limitation (emitter ballasting) is the preferred method for increasing the ruggedness.

Basic technology for 1 GHz

Figure 4 shows a schematic cross-section for the device structure in use for up to 1 GHz. A typical interdigitated cell layout was shown in figure 3, with the position of the cross section in figure 4 marked with an arrow. Common silicon planar technology is used. A principle design and process flow is shown in figure 5.

At high current levels, only the periphery of the emitter areas is delivering power because of the current crowding effect. The emitter perimeter is therefore made very large and the fingers very narrow. The base contact fingers are placed between the emitters, thus reducing the extrinsic base resistance from the base contact to the emitter edge, to increase RF gain. The metallization extends on top of the emitter and base contact areas. Very little parasitic resistance is added compared to other layout principles.

There is no interdevice isolation; the whole silicon substrate is the collector, which means that no circuit functions can be designed using a single chip in this technology. Emitter and base are contacted using the front side bond pads.

There are various methods to obtain high breakdown voltage at the device edges. For Ericsson's 1 GHz technology, a classical method with three floating depletion rings is used. The rings have the same doping as the base region, but are not connected. This method requires no extra process steps, only changes in the mask layouts.

The "pitch," defined as the emitter-base opening periodic distance, is 4-5 µm for a 1 GHz device, and the emitter and base openings are typically 1 to 1.5 µm wide.

The very high currents and narrow metallization lines complicate the use of aluminum (Al) for metallization. Electromigration, the wear-out phenomenon at high current densities in thin metallization lines, will eventually cause device failures and limit the long-term reliability of the devices.

Instead, metallization consists of a single layer 1-2 µm thick gold (Au), which is very resistant to electromigration. The metal can be sputtered and etched/ion milled or electroplated using a resist mask. All Ericsson RF power transistors are electroplated. A titanium-tungsten (TiW) layer is used under the gold to ensure excellent reliability of the metallization system and adhesion to the underlying layers. A silicide (preferably platinum silicide, PtSi) is often used in the emitter and base openings to lower the contact resistance and thus the parasitic base resistance.

Basic technology for 2 GHz

As the demands for higher operating frequencies have grown, a structure similar to figure 6 has been brought into use for PDC (1500 MHz), PCS (1900 MHz), etc. and for new frequency bands above 2 GHz.

To reduce parasitic capacitance from the metallization to the substrate to sustain RF gain, the thickness of the field oxide isolation has been increased from around one micron to at least three microns.

Such a thick isolation can be achieved

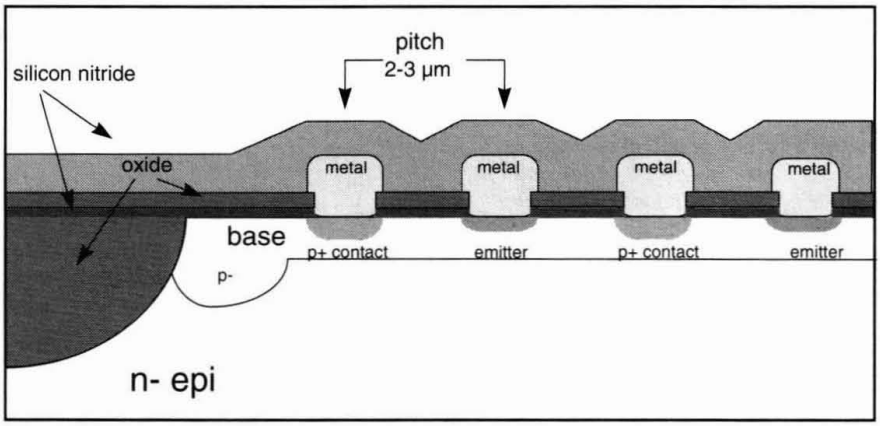

Figure 6. Cross-section of device structure for 2+ GHz technology.

by increasing the initial thermally grown oxide or depositing a thick isolation layer, and then an etch to open the device areas. Another method is to use a LOCOS isolation, similar to a CMOS device but with much larger oxide thickness.

However, to successfully open the small emitter/base contacts and metalize the narrow openings, reducing the topology is necessary. Instead, various forms of fully recessed local oxidation can be applied with an almost planar structure as a result. The recessed structure is obtained by depositing a nitride/oxide layer as for a
LOCOS structure. The nitride/oxide is then etched outside the device areas. The etching is continued up to one micron into the silicon substrate. After a long oxidation, that can be accelerated by the use of high-pressure oxidation (HIPOX), and a planarization to reduce the "bump" at the oxide/device area edge, the almost perfectly planar structure in figure 6 is obtained.

To further reduce parasitic R and C to increase gain, the pitch has been scaled from 4 to 5 µm for the 1 GHz device to half that value. The emitter and base openings are typically 0.7 to 1.2 µm wide in this technology.

Another change to reduce parasitic capacitance, a different edge breakdown method, was applied for this structure, namely junction termination (JTN). By increasing the doping near the device edges (by implantation and diffusion), the collector-base breakdown was increased to very close to the theoretical limit. The JTN occupies less area than the guard rings used for the 1 GHz devices, thus lowering the C-B capacitance.

Similar to high-speed low-voltage bipolar transistors, the use of polysilicon emitters can improve the performance, mainly by higher transistor emitter efficiency, resulting in higher f_T and f_{max}. However, the improvements appear to be quite modest for this type of device and the problems associated with manufacturing stability and repeatability are well known. Ericsson's 2 GHz technology does not use polysilicon emitters, but will when the pitch is shrunk below 2 µm.

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[3] R. Allison, "Silicon Bipolar Microwave Power Transistors", IEEE Trans. Microwave Theory & Techniques., Vol. MTT-27, No. 5, p. 415, 1979.

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LDMOS Devices Provide High Power for Digital PCS

Prepared by Cindy Blair, Ericsson Components, RF Power Products

Cellular radio has evolved from analog systems transmitting a single conversation per base station amplifier to complex systems using digital modulation, such as code division multiple access (CDMA), that transmit many conversations over a single channel. Single channel analog systems using FM modulation don't require linear power amplifiers. Complex waveforms associated with newer systems, however, contain amplitude and phase variations requiring very linear power amplifiers. Further, newer analog systems often combine channels *before* amplification. These multi-carrier power amplifiers (MCPAs) need high amplifier linearity to meet required intermodulation distortion (IMD) performance. Both CDMA and MCPA waveforms have high peak-to-average power ratios so amplifiers must operate significantly below saturation. As a result, amplifiers for CDMA or other "spectrally efficient" modulation systems and MCPAs have significantly higher IMD requirements for their active devices.

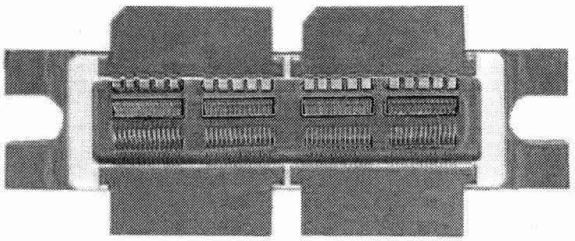
Most single channel analog base station amplifiers use silicon bipolar power transistors. RF transistor technology, developed in the 1960s, has improved over the years in terms of gain, output power, efficiency and reliability. Linearity, however, is limited by fundamental characteristics of bipolar transistors. Bipolars have two significant linearity problems: high order IMD, and low level crossover distortion. The latter, crossover distortion, can be improved by changing from class AB to class A bias. This, however, reduces both efficiency and peak power compared to class AB bias.

LDMOS Transistor Performance

MOSFETs have lower high order IMD than bipolar transistors. Since they are majority carrier devices, they don't require the ballasting that stabilizes minority carrier bipolars. Combined, these MOSFET traits produce superior IMD at reduced output power. Additionally, thermally stable FET cells combine better than cells of bipolar transistors. This makes it easier to scale active area when designing high output power components. Recently introduced Laterally Diffused Metal Oxide Semiconductors (LDMOS) increase operating frequency of silicon power FETs. LDMOS incorporates a "p+ sinker" to connect the source terminal to the chip's back side. With this structure, chips are directly attached to metal flanges both to improve grounding and reduce thermal resistance. LDMOS technology makes it possible to produce RF power transistors having high gain, usable efficiency, low thermal resistance and superior IMD when applied in cell radio systems.

Ericsson's PTF 10120 (figure 1) is an enhancement mode LDMOS transistor rated for 120 Watts PEP output in 1.8–2.0 GHz communication systems. Typical power gain is 10.5 dB when biased class AB at 28 Volt drain supply. The PTF 10120's chip and package are similar to those employed in other Ericsson 1 and 2 GHz volume production LDMOS transistors.

Structurally, the transistor combines four active chips assembled in a push-pull configuration. Each chip contains twenty-eight (28) cells having sixty (60) 0.8 micron length gates. Input and output are internally matched to optimize broadband performance. Matching consists of bond wire inductors and MOS capacitors configured as a low-pass impedance matching transformer on the input, and a band-pass network (shunt inductor, series blocking capacitor) on the output.



Operating Voltage, V_{DD}	28 V_{DC}
Thermal Resistance, $R_{\theta JC}$	0.39 °C/W
Gate Threshold Voltage, $V_{GS(th)}$	3.8 V_{DC} Typ
Gain (28 V @ 1.2 A I_{DQ}, P_{OUT} = 30 W, 1.93-1.99 GHz)	11 dB Typ
Power Output at 1 dB Compressed, P-1dB	120 W
Drain Efficiency, η_D	40% Typ

Figure 1. Ericsson's PTF 10120 LDMOS FET.

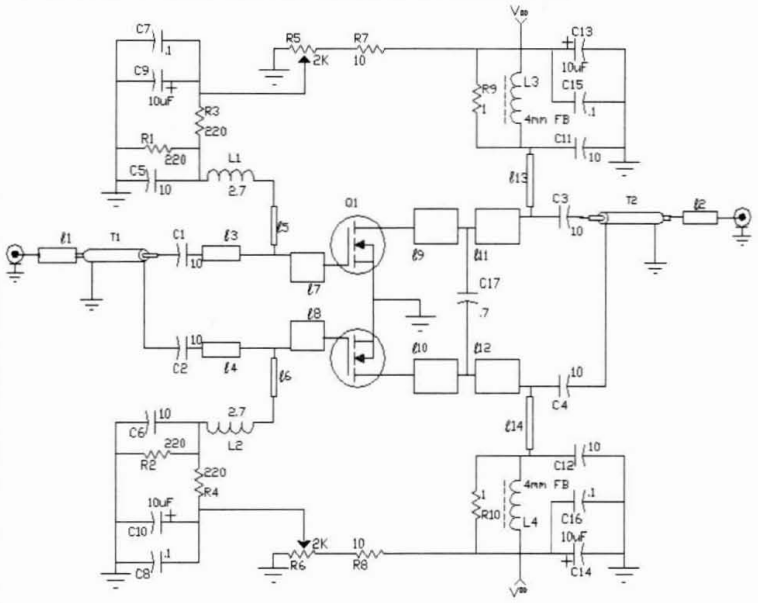
All Ericsson LDMOS products employ gold metallization. Developed in the 1970s, gold replaced lower reliability aluminum on microwave power chips to overcome metal migration failures. Ericsson products also use gold wire interconnects to reduce wire temperature and eliminate wire fatigue occurring in systems amplifying time varying waveforms. Ericsson's all gold system eliminates intermetallic failures associated with mixed metal systems.

120 Watt Amplifier Performance

A push-pull test circuit was designed to operate from 1930 to 1990 MHz using 1:1 compensated baluns at the input and output and cascaded input and output matching networks. Matching networks were designed to optimally transform the balanced source and load to device impedances determined by point by point load-pull characterization using tuners. Matching networks combine distributed and lumped components in the low pass configuration shown schematically in figure 2.

The test circuit was fabricated on a .031" thick substrate having a dielectric constant of 4.0. The layout, shown in figure 3, illustrates the simplicity typical of circuits designed around internally matched LDMOS transistors.

Bias considerations



Q1 - 10120, LDMOS RF Transistor
ℓ1, ℓ2 - Microstrip 50 Ω
ℓ3, ℓ4 - .048 λ @ 2.0 GHz, Microstrip 31.7 Ω
ℓ5, ℓ6 - .18 λ @ 2.0 GHz, Microstrip 70 Ω
ℓ7, ℓ8 - .097 λ @ 2.0 GHz, Microstrip 9.35 Ω
ℓ9, ℓ10 - .129 λ @ 2 GHz, Microstrip 7.6 Ω
ℓ11, ℓ12 - .031 λ @ 2 GHz, Microstrip 8.8 Ω
ℓ13, ℓ14 - .25 λ @ 2 GHz, Microstrip 65 Ω
C1, C2, C3, C4, C5 - 10 pF Chip Cap, ATC 100 B
C6, C11, C12 - 10 pF Chip Cap, ATC 100 B
C7, C8, C15, C16 - 0.1 µF Chip Cap, K1206
C9, C10, C13, C14 - 10 µF SMT Tantalum Cap
C17 - 0.7 pF Chip Cap, ATC 100 B
L1, L2 - 2.7 nh, SMT Coil
L3, L4 - 4 mm, SMT Ferrite Bead
R1, R2, R3, R4 - 220 Ω Chip Resistor, K1206
R5, R6 - 2 K SMT Potentiometer
R7, R8 - 10 Ω Chip Resistor, K1206
R9, R10 - 1 Ω Chip Resistor, K1206
T1, T2 - 50 Ω Coaxial Balun

Figure 2. Test Circuit Block Diagram for f = 2.0 GHz

Biasing a FET is much simpler than biasing a bipolar because FETs don't require a temperature controlled voltage source. Output bias consists of a bypassed RF choke, similar to that used in bipolar circuits. Gate bias can consist of a simple resistive divider connected between the drain supply and ground. At the low drain current corresponding to optimum linearity, LDMOS transistors have a positive temperature coefficient. At high current (i.e. when driven to peak power), temperature coefficient is negative. The negative coefficient at high current eliminates thermal runaway that may cause failure in uncompensated bipolar circuits.[1] A somewhat more complex compensation network improves LDMOS linearity over temperature.

Performance Measurements

Figures 4 through 8 illustrate measured performance of the prototype circuit. The circuit operates from a 28-volt supply with drain current set to 600 mA for each side of the PTE 10120.

Figure 4 shows the power output vs. power input curve of the test amplifier. Typical power at P-1dB is 135 watts.

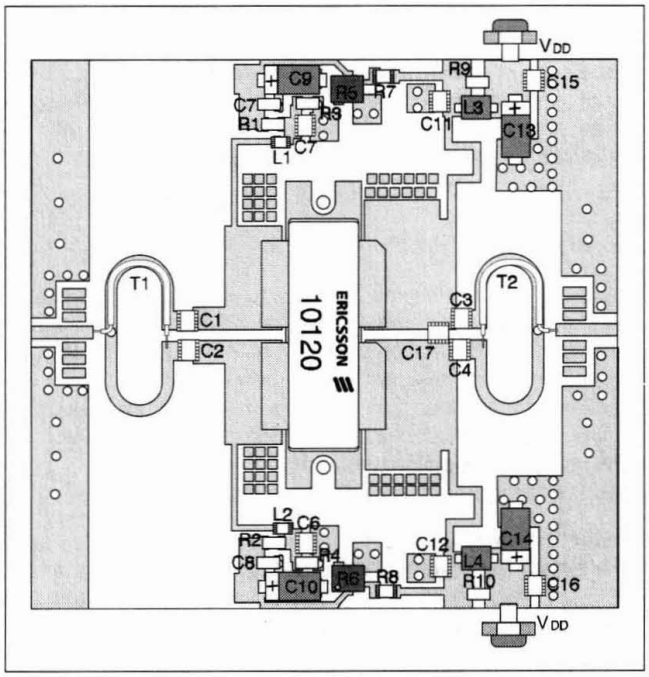


Figure 3. Layout of the amplifier circuit in figure 2.

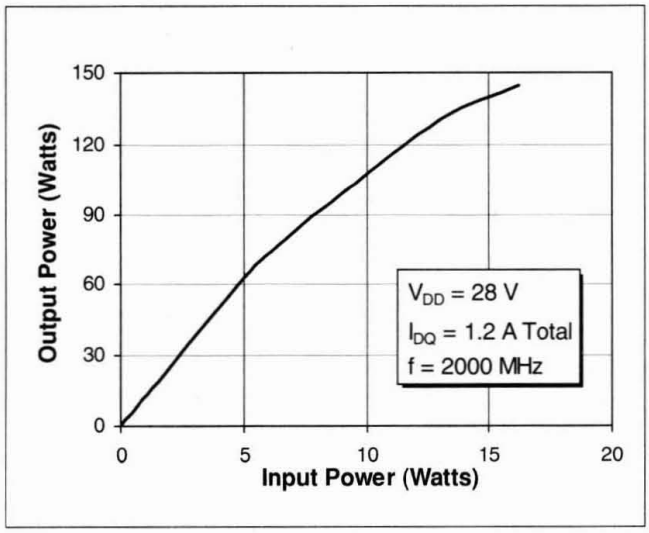


Figure 4. Typical output power vs. input power.

Figure 5 shows small signal gain and efficiency at P-1dB, in a fixture optimized from 1930-1990 MHz.

Linearity

Figure 6 shows two-tone 3rd, 5th and 7th order IMD versus output power. It's notable that, although not completely monotonic, IMD generally decreases continually as output decreases. Bipolar transistors tend to have a more noticeable "sweet spot," an output range corresponding to minimum distortion. This is largely due to the more linear transfer function of LDMOS compared to bipolar transistors. Figure 7 shows comparable bipolar IMD performance.

CDMA Testing

Testing was performed with a standard 18 channel forward link

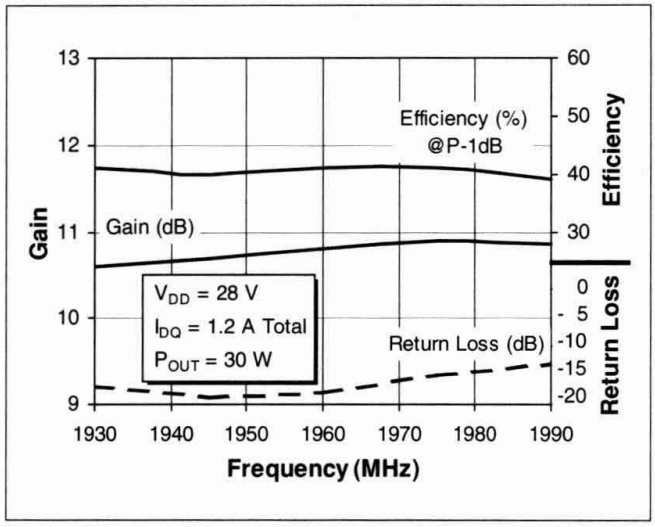


Figure 5. Broadband test fixture performance.

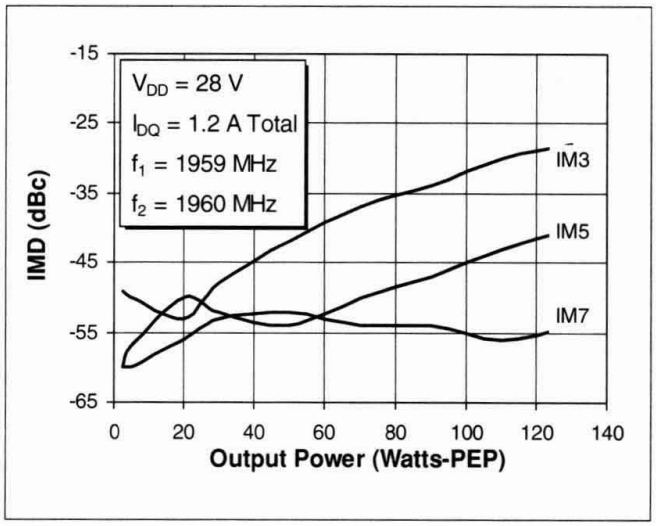


Figure 6. Typical IMD performance of the PTF 10120.

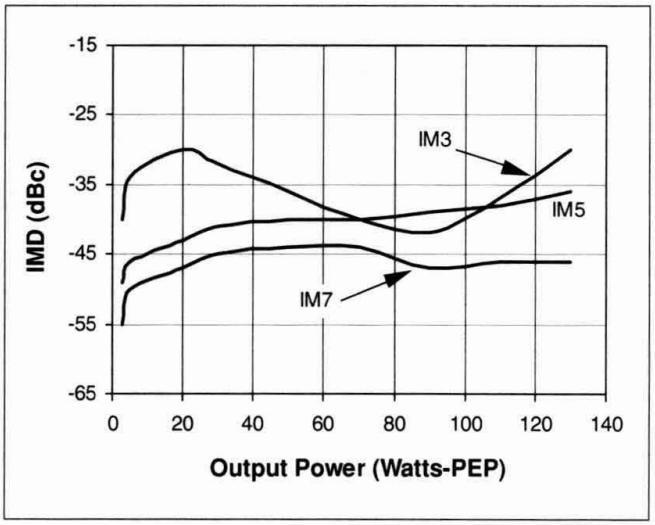


Figure 7. Typical IMD for an equivalent bipolar transistor.

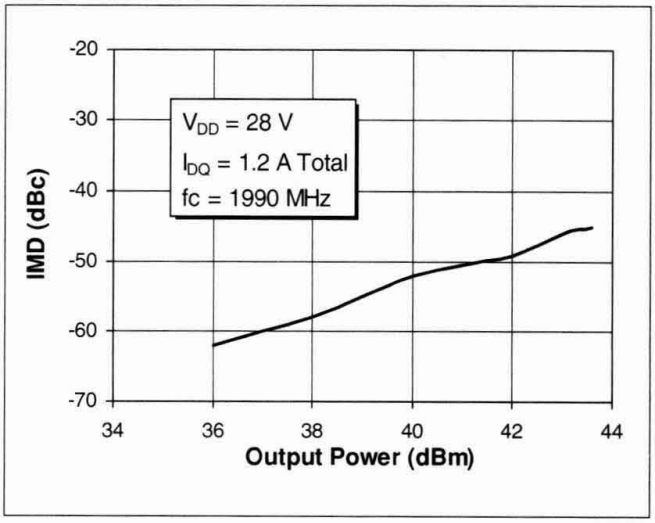


Figure 8. ACPR vs. CDMA output power at 885 kHz offset.

CDMA signal. Figure 8 shows the higher of the two values of ACPR ratio at 885 kHz offsets. Performance clearly illustrates the suitability of LDMOS when amplifying complex waveforms.

Ericsson Components offers a full range of LDMOS and bipolar RF power transistors for the PCS/Cellular bands. Figures 9 and 10 show suggested line-ups for complete CDMA or TDMA 2 GHz high power (120 and 240 watt) applications.

For additional information contact Rich Thurow at 1-408-778-

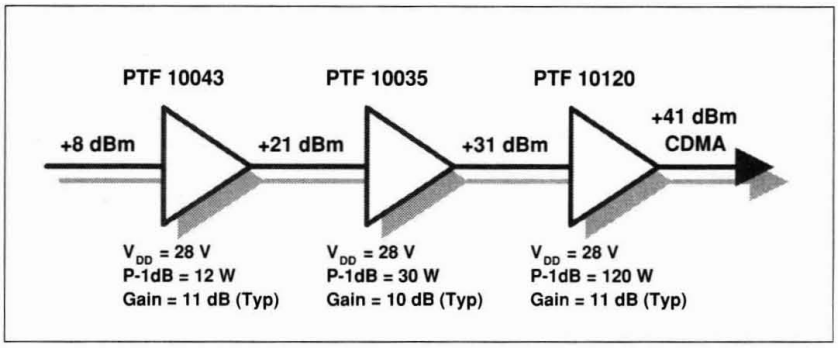


Figure 9. Recommended transistor lineup for a 120 watt (+41 dBm) CDMA transmitter.

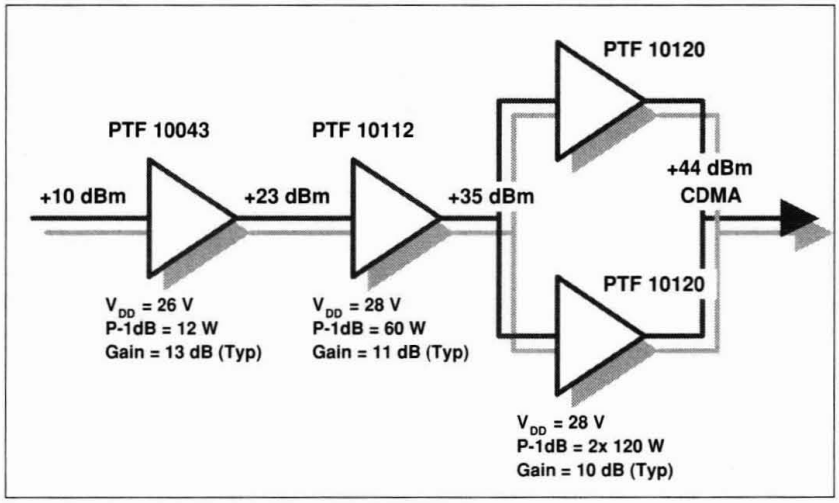


Figure 10. Recommended transistor lineup for a 240 watt (+44 dBm) CDMA transmitter using two PTF 10120s.

9434.

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Acknowledgment

The author would like to thank Jim Curtis for his excellent editing input on this article.

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Biasing LDMOS FETs for Linear Operation

By Cindy Blair, Ericsson Microelectronics, RF Power Products

The new CDMA and WCDMA wireless standards have dramatically impacted the optimization criteria that a wireless base station designer might choose in designing or selecting RF Power amplifiers. Now, more than ever before, linearity is of paramount importance. Lateral DMOS devices have provided superior performance at a reasonable price per watt. RF Power amplifier designers must choose the bias point that will give them the best trade-offs between linearity, gain, and efficiency. In order to provide these high degrees of linearity under all reasonable conditions, this bias point must be reasonably maintained over time and temperature.

A FET device has three things that change with temperature: the gate threshold shifts, the gm drops, and $R_{DS(on)}$ lowers. The combined result of this is shown in figure 1. Figure 1 is a typical temperature plot given by most manufacturers of commercial LDMOS devices. The gate bias values shown are normalized to 1 volt at 25° C; and depict the bias values needed to maintain the graphed current point over temperature.

At low drain currents, the LDMOS device has a positive temperature coefficient. As the drain current increases, the positive coefficient becomes progressively less positive, until at very high currents it goes negative. This is wonderful protection against thermal run-away, but it makes the designer's job a little more difficult. These plots serve as a good basic guideline, but the designer should be aware that normal process variations might affect these curves slightly.

Basic Considerations

In all FET bias circuits it is of paramount importance that the gate bias voltage be derived from a very well regulated source. It is also assumed that whatever sense element is used that it be thermally linked to the device for which it is providing the correction reference. With the low currents present in the gate circuitry this can be accomplished simply and very inexpensively. Furthermore, in linear operation, any "corrective" bias circuit will be reducing the bias voltage with temperature to retain the same operating point; while at the same time gm is dropping this will appear as less amplifier gain at high temperatures. The gain change is slight, and most system designers provide a system ALC loop, which should mask this effect in the end product. However, it is worth mentioning here.

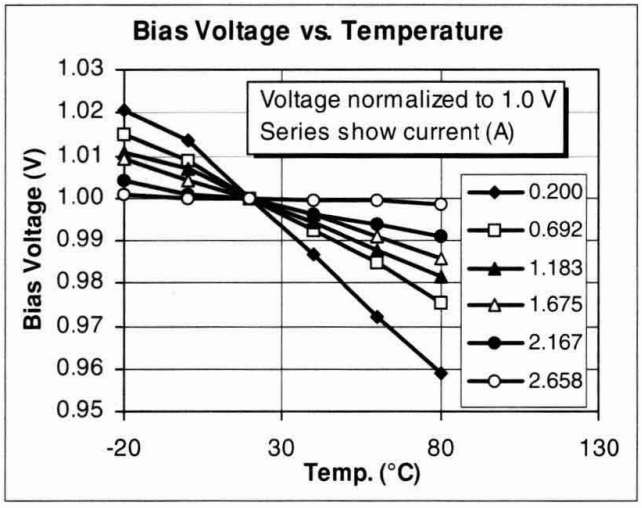
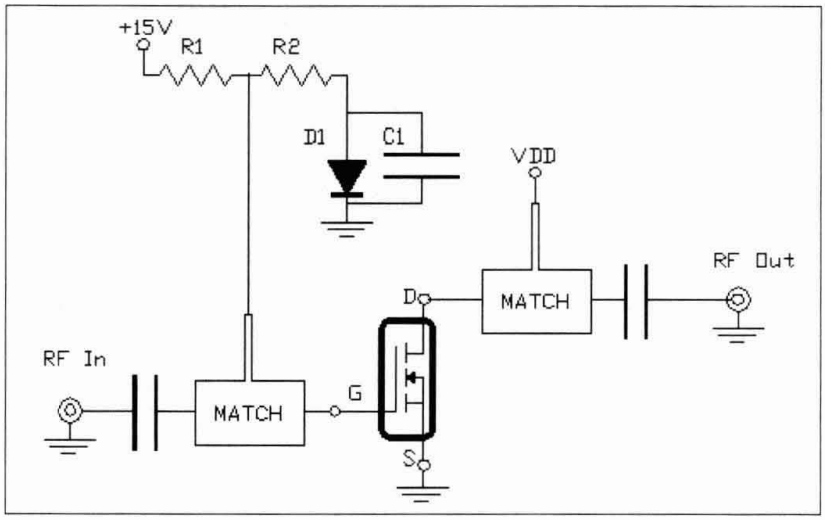


Figure 1. Typical temperature plot.

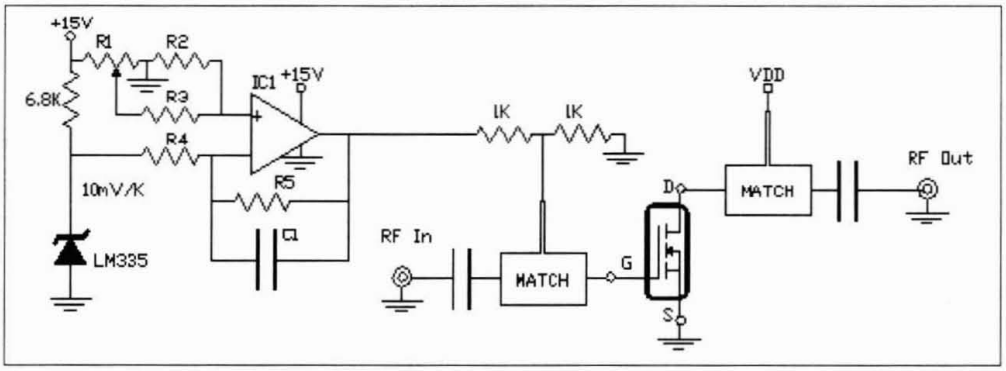
1 – The diode compensation network

Diode compensation networks are perhaps the simplest and most widely used bias circuit. They have been used for years in bipolar circuits to prevent thermal run-away. There are excellent application articles available for their use in FET products as well. (note) Operation is very straightforward. As D1 becomes hotter its enhanced conduction will increase the current through R2, thus altering the divide ratio of R1/R2/D1. Single diode networks are, however, somewhat limited in that it is more difficult to tailor the compensation curve to a specific device curve without additional circuitry. One may also series two or more diodes to increase the amount of compensation available.



Diode compensations network.

2 – The thermal sensor



Thermal sensor.

If the designer desires a bit more sophistication, a thermal sensor may be used. This eliminates the guesswork and extra characterization associated with the diode compensator. The designer simply looks up the thermal coefficient of their device at the specific desired operating current, then compares that to the 10 mV/K slope of the temperature sensor (in this case, LM335). A simple Op-Amp circuit takes care of providing the desired slope conversion. In the figure above, R1 can be replaced by whatever provides main bias control for the device (e.g. I_{DQ} set from the system controller). R4 will adjust the amount of temperature slope at the output of IC1. R2, R3, and R5 may be tailored to the bias controls of individual systems. This is a fairly well behaved configuration that is easily modeled in Spice.

3 – The "like material" reference:

When the designer wants the most perfect mirroring effect in a compensation circuit there is no substitute for a "like material" reference. Q2 contains die that is similar in construction to the die contained in Q1, but is much smaller (for this discussion 1/56 size). R5 and R6 set the gate bias on Q2, typically set so that the drain current is scaled down to the same ratio as the difference in die size. For example, if the normal operating current in Q1 is 2.6 amperes, Q2 would be set to run at 1/56 of that value (assuming a 56:1 Q1-Q2 size ratio). As Q2 changes temperature, the change in current causes the drain voltage of Q2 to change. This voltage feeds the correction input of the Op-Amp Summing circuit above.

A second, less obvious advantage to this topology is compensation for hot electron effects. High frequency (short gate length) Lateral DMOS devices exhibit over time a gate oxide charging phenomenon[1] . This oxide charging leads to an upward shift in threshold voltage in the enhancement mode device. For example, assume that the gate bias of a FET is set so that the quiescent drain current is 1 ampere. If the FET is operated for 20 years and the quiescent current is re-measured as .95 A, the FET has drifted 5% due to this oxide charging effect. One ampere was the value of quiescent current that provided optimal linearity performance; consequently the linearity performance (and small signal gain) of our device has degraded over time. These effects are minimized if the gate bias is increased over time to compensate for the charging effect. In the ideal case, V_{DD}^{*} will be above V_{DD} so that with the current drawn the actual V_{DD} of Q2 will approximate V_{DD} on Q1. One very important assumption for this is that both transistors are "new" when installed (on a mass production base station line this will not be an issue). When properly implemented, the "like material" reference compensates for many drift and thermal effects. This is certainly not a perfect solution, but it allows offsetting negative characteristics to subtract; even if material types are not perfectly matched you are still subtracting errors.

Although device manufacturers are continually reducing this drift effect, it will be a factor for some time to come. The "like material" reference eliminates the need for burn in, but requires the amplifying and compensating devices be of identical "age." This adds substantial cost to any field replacement of devices.

The correction circuits presented here are generic in nature, and may be modified to individual system requirements. This paper is intended as a general reference only. Equations for the sum/ difference circuits are available in the references. Most of these correction circuits are easily modeled. If a higher degree of manufacturing ease is needed a custom integrated circuit could be produced for method 1 or 2.

[1] Robert F. Pierret; *Semiconductor Device Fundamentals*, 1996, Addison-Wesley.

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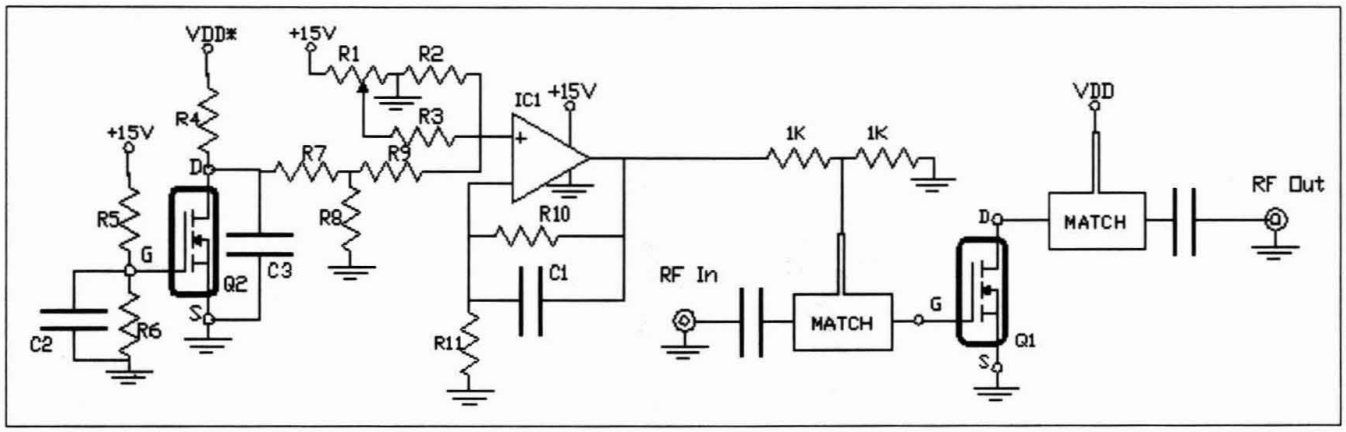
5. Edwin S.Oxner; *FET Technology and Application,* Marcel Dekker, Inc. 1989.

6. Scott Porro; Ericsson application note "FETs Address Linearity Challenge."



"Like material" reference.

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Ericsson's W-CDMA LDMOS Breakthrough

Prepared by Tim Ballard, Ericsson Microelectronics, RF Power Products

Wireless telephony has evolved from analog systems transmitting a single conversation per base station amplifier to complex systems using multiple-subscriber digital modulation techniques. Traditional "narrow-band" code division multiple access (CDMA) transmits conversation and paging over a single channel. The recently introduced wideband CDMAM (W-CDMA) networks will support a wider range of wireless digital services, such as Internet/intranet and other IP-based applications, video, high-speed datacoms and interactive services. The information density of these more complex signals requires higher degrees of amplifier linearity to meet necessary adjacent channel power ratio (ACPR) specifications. During low cumulative probability distribution (CPR), W-CDMA waveforms have high peak-to-average power ratios. At high CPR, W-CDMA waveforms have lower peak-to-average power ratios, requiring amplifiers to operate significantly below saturation. The result: amplifiers for W-CDMA and other "spectrally efficient" modulation systems have significantly higher IMD requirements for their active devices.

Most first generation cellular base station amplifiers used silicon bipolar power transistors. RF transistor technology has improved over the years in terms of gain, output power, efficiency and reliability. Linearity, however, is limited by fundamental characteristics of bipolar transistors. Bipolars have two significant linearity problems: high order intermodulation distortion (IMD), and low level cross-over distortion. The latter, crossover distortion, can be improved by changing from class AB to class A bias. This, however, reduces both efficiency and peak power when compared to class AB bias.

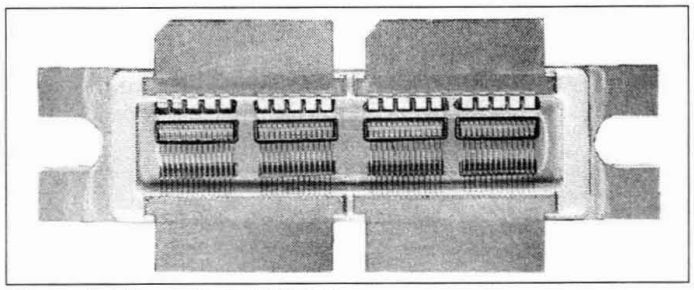

Figure 1. Ericsson's PTF 10134.

LDMOS Transistor Performance

MOSFETs have lower high order IMD than bipolar transistors. Being majority carrier devices, they don't require the ballasting that stabilizes minority carrier bipolars. Combined, these MOSFET traits produce superior IMD at reduced output power. Additionally, thermally stable FET cells combine better than cells of bipolar transistors. This makes it more feasible to scale active area when designing high output power components. Recently introduced laterally diffused metal oxide semiconductors (LDMOS) have increased the operating frequency of silicon power FETs. LDMOS incorporates a "p+ sinker" to connect the source terminal to the backside of the semiconductor material. With this structure, chips may be directly attached to metal flanges. The direct contact improves grounding, and reduces thermal resistance; it also eliminates the need for source interconnects, and reduces parasitic source inductance. LDMOS technology makes it possible to produce RF power transistors having high gain, usable efficiency, low thermal resistance and superior IMD when applied in wireless radio systems.

Ericsson's PTF 10134 (Figure 1) is an enhancement mode LDMOS transistor rated for 100 watts PEP output in W-CDMA communication systems at 2.11 to 2.17 GHz. Typical power gain is 10.0 dB when biased class AB at 28 volts drain supply. The PTF 10134's chip and package are similar to those employed in other Ericsson 1 and 2 GHz volume production LDMOS transistors.

Structurally, the transistor combines four active chips assembled in a push-pull configuration. Each chip contains twenty-eight (28) cells having sixty (60) 0.8-micron length gates. Input and output are internally matched to optimize performance within the W-CDMA band. Matching consists of bond wire inductors and MOS capacitors configured as a low-pass impedance matching transformer on the input, and a shunt L network (shunt inductor, series blocking capacitor) on the output.

All Ericsson LDMOS products employ full gold metallization. Developed in the 1970s, gold replaced lower reliability aluminum on microwave power chips to overcome metal migration failures. All Ericsson products use gold wire interconnects to reduce wire temperature and eliminate wire fatigue occurring in systems amplifying time-varying waveforms. Ericsson's all–gold system eliminates intermetallic failures associated with mixed metal systems.

100 Watt Amplifier Performance

A push-pull test circuit was designed to operate from 2110 to 2170 MHz using 1:1 compensated baluns at the input and output. A cascaded input and tapered output are utilized as matching networks. Matching networks were designed to optimally transform the balanced source– and load–to–device impedances determined by point by point load-pull characterization using a manual tuning system. Matching networks combine distributed and lumped components in the low pass configuration shown schematically in Figure 2.

The circuit was fabricated on a substrate with .028" dielectric thickness and having a dielectric constant of 4.0. The layout, shown in Figure 3, illustrates the simplicity typical of circuits designed around internally matched LDMOS transistors.

Bias considerations

Biasing a FET is much simpler than biasing a bipolar because FETs do not exhibit high current thermal run-away. Output bias consists of a bypassed RF choke, similar to that used in bipolar circuits. Gate bias can consist of a simple resistive divider connected between the drain supply and ground.[1] A somewhat more complex compensation network improves LDMOS linearity over temperature.[3]

Linearity

Figure 6 shows two-tone 3rd, 5th and 7th order IMD vs. power output. It's notable that, although not completely monotonic, IMD generally decreases continually as output decreases. Bipolar transistors tend to have a more noticeable "sweet spot," an output range corresponding to minimum distortion. This is largely due to the more linear transfer function of LDMOS compared to bipolar transistors. Figure 7 shows comparable bipolar IMD performance.

Ericsson Components offers a full range of LDMOS and Bipolar RF power transistors for the W-CDMA, PCS and cellular bands. Figures 9 and 10 show suggested line-ups for complete W-CDMA 2.2 GHz power applications.

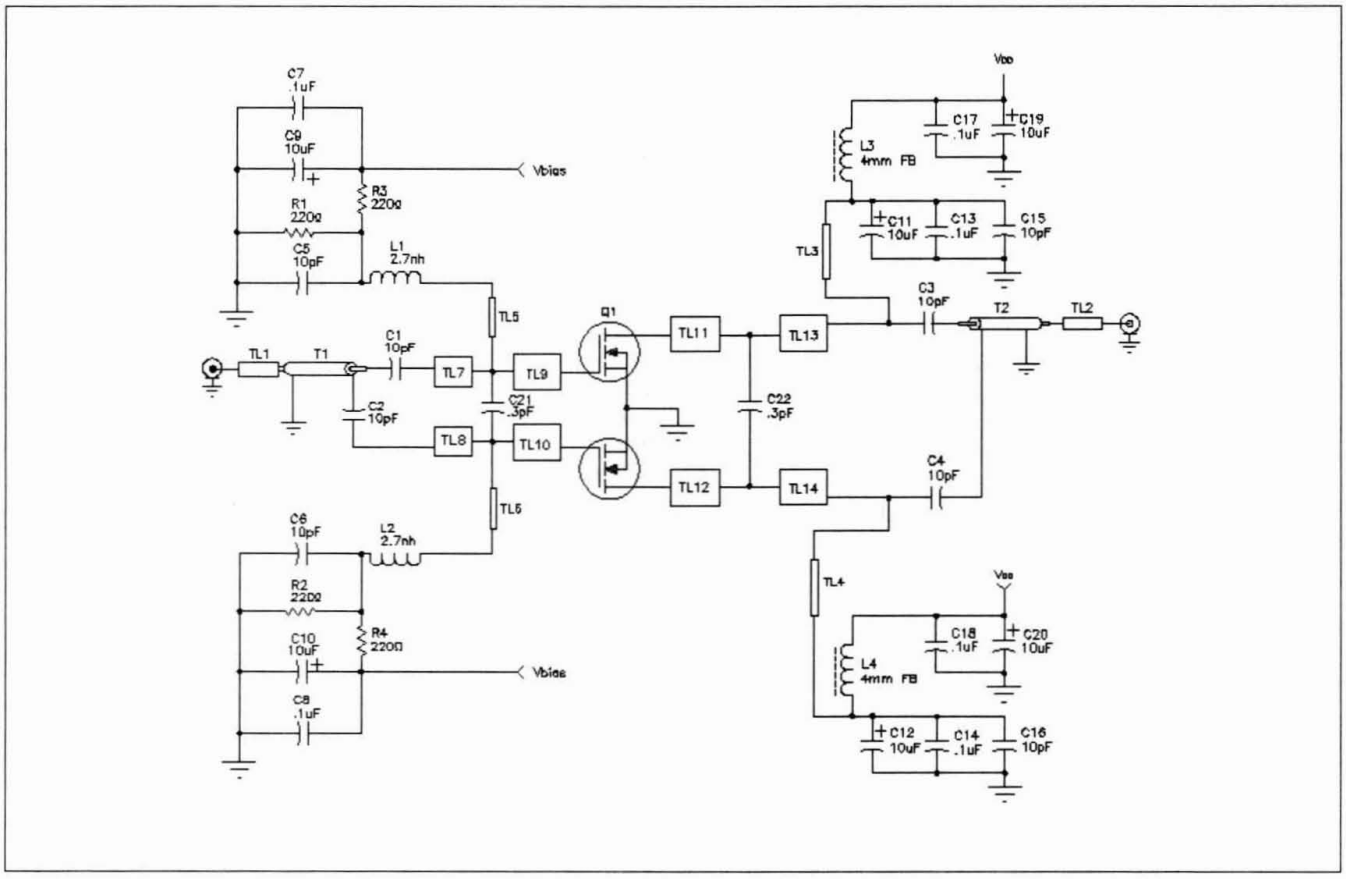

Figure 2. Test circuit schematic for PTF 10134.

ℓ1, ℓ2 - Microstrip 50 Ω
ℓ3, ℓ4 - Microstrip 8.15 Ω .053λ 2GHz
ℓ5, ℓ6 - Microstrip 6.7 Ω .055λ 2GHz
ℓ7, ℓ8 - Microstrip 16.9 Ω .060λ 2GHz
ℓ9, ℓ10 - Microstrip 8.15 Ω .053λ 2GHz
ℓ11, ℓ12 - Microstrip 6.7 Ω .055λ 2GHz
ℓ13, ℓ14 - Microstrip 16.9 Ω .060λ 2GHz
L1, L2 – 2.7 nH SMT coil
L3, L4 – SMT Ferrite
T1, T2 – 50 Ω coaxial balun

R1, R2, R3, R4 – 220 Ω chip resistor
R5, R6 – 2 K SMT Potentiometer
R7, R8 – 10 Ω chip resistor
R9, R10 – 1 Ω chip resistor
C17– 0.7 pF chip cap
C1, C2, C3, C4 – 10 pF chip cap
C5, C6, C11, C12 – 10 pF chip cap
C7, C8, C15, C16 – 0.1 µF chip cap
C9, C10, C13, C14 – 10 µF SMT tantalum

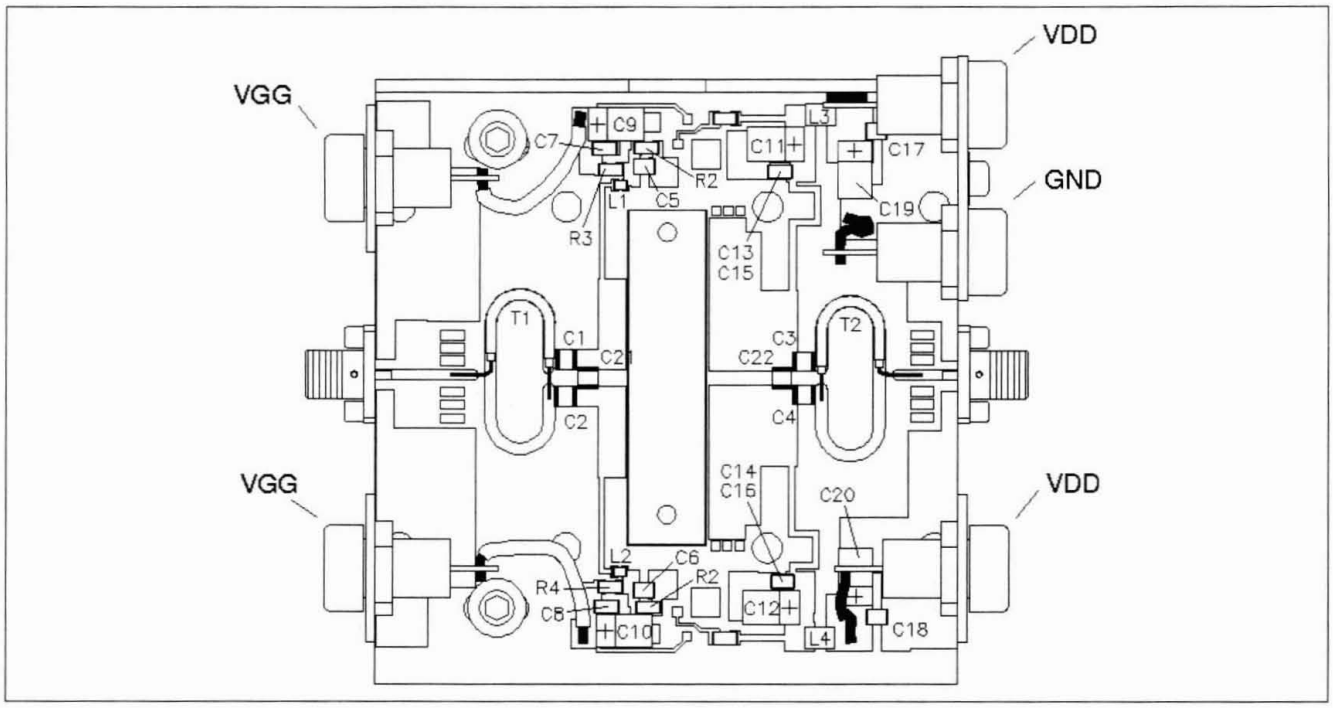

Figure 3. Test circuit assembly for PTF 10134.

Performance Measurements

The following figures illustrate measured performance of the prototype circuit. The circuit operates from a 28-volt supply with drain current set to 650 mA for each side of the PTF 10134.

Figure 4 shows the power output vs. power input curve of the test amplifier. Typical power at P-1dB at CW is 110 watts. Figure 5 shows small signal gain and efficiency at P-1dB in a fixture optimized from 2110-2170 MHz.

W-CDMA Testing

Testing was performed with W-CDMA mask at 15 DTCH signal. Figure 8 shows the higher of the two values of ACPR at 4.096 MHz offsets. Performance clearly illustrates the suitability of LDMOS when amplifying complex waveforms.

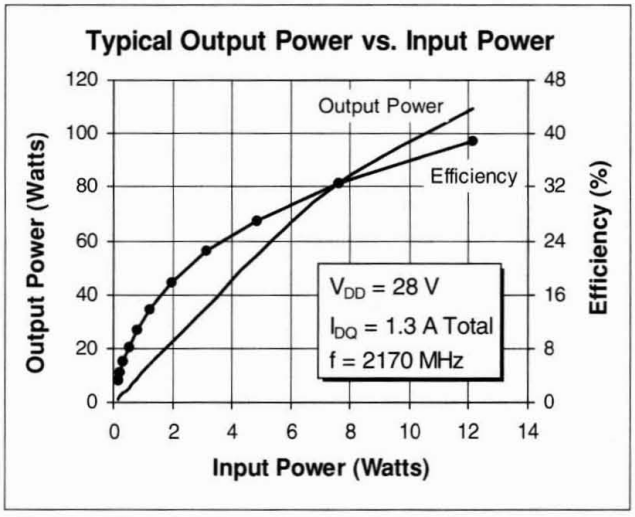

Figure 4. Typical performance for PTF 10134.

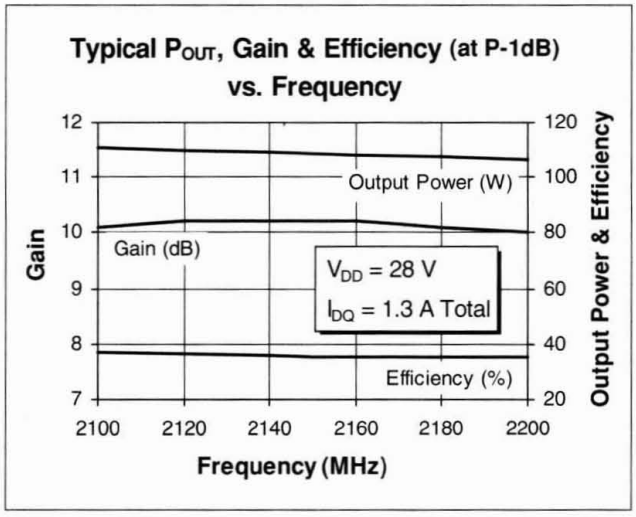

Figure 5. Typical performance for PTF 10134.

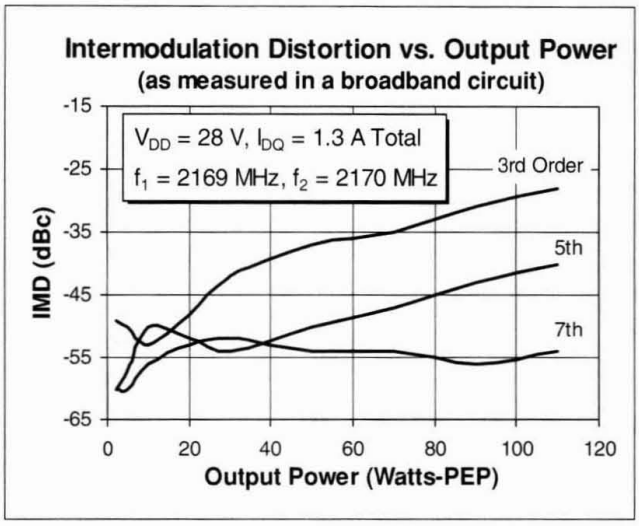

Figure 6. Typical performance for PTF 10134.

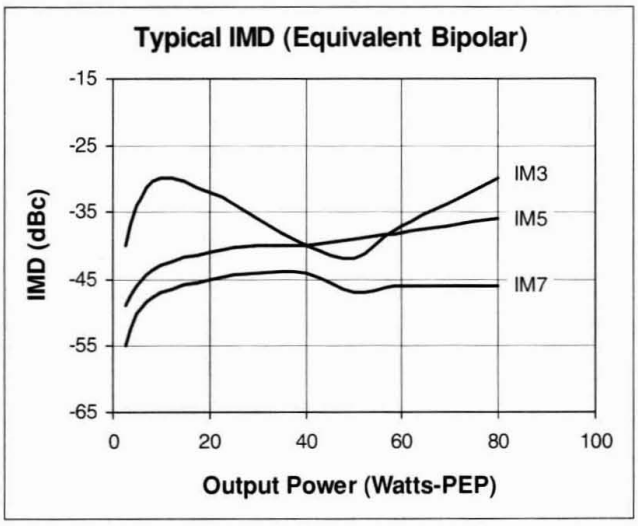

Figure 7. Typical performance for PTF 10134.

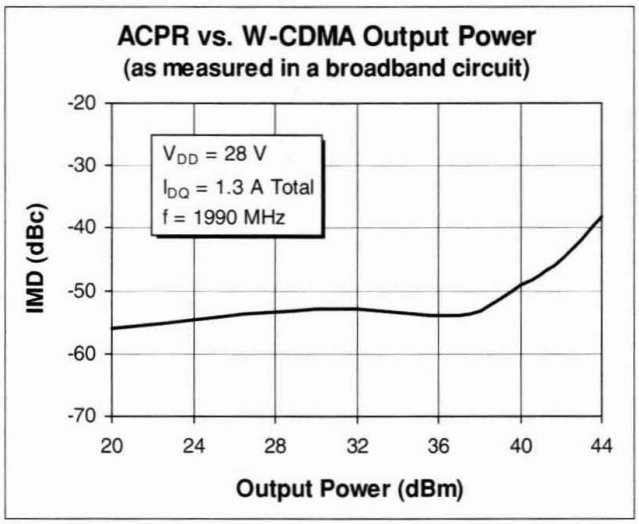

Figure 8. Typical performance for PTF 10134.

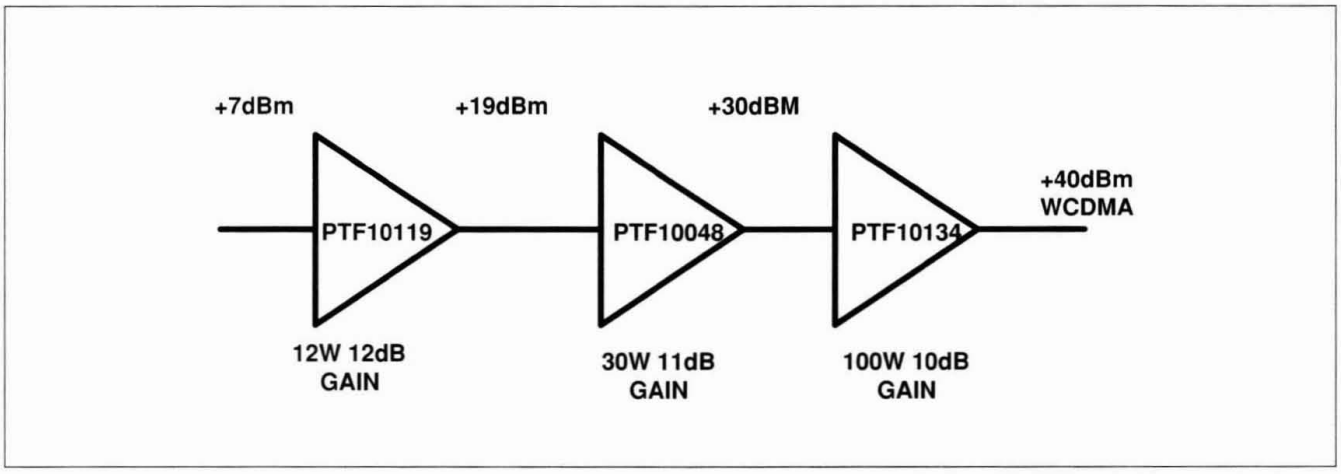

Figure 9.

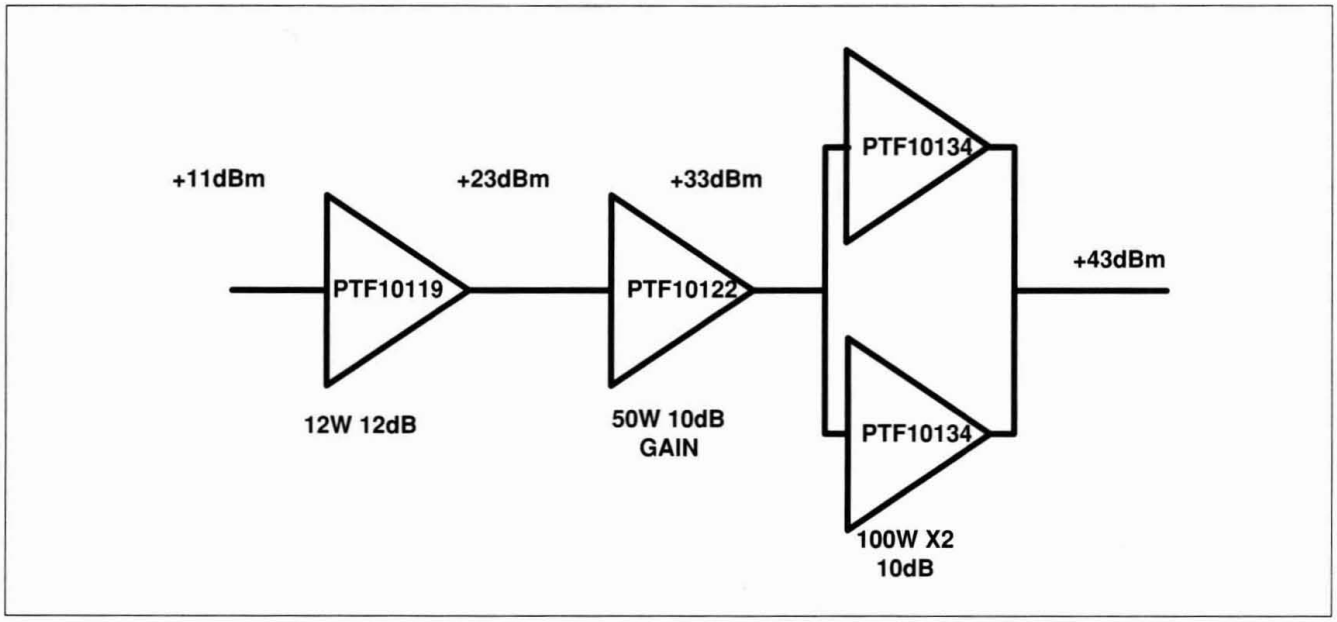

Figure 10.

References:

1. S. Porro, "FETs Address Linearity Challenge," Ericsson Microelectronics *RF Power Transitors Data Book 1998/1999*, pp 12-6 - 12-8.
2. C. Blair, "Ericsson's High Power LDMOS Breakthrough," *Applied Microwaves and RF Magazine*, October 1998.
3. C. Blair, "Biasing LDMOS FETs for Linear Operation," Ericsson Microelectronics *RF Power Transistors Year 2000 Data Book.*

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Ericsson HIT™ User Guide

Prepared by Bob Bartola, Ericsson Microelectronics, RF Power Products

The purpose of the *Ericsson HIT Users Guide* is to assist the amplifier/system designer to maximize the RF performance of the HIT for various applications. Included below in the HIT Users Guide are the following categories:

1. What is a HIT?
2. HIT/Discrete form, function comparison
3. HIT Biasing
4. HIT circuit layout.
5. System Lineups utilizing HITS

What is a hit?

"HIT" refers to "High Impedance Technology." The HIT utilizes the same LDMOS transistor die as it's discrete counterparts, but is internally matched to a 50 Ω input impedance and a 50 Ω load impedance within the device package. Additionally, temperature compensation, and bias circuitry are also included.

HIT/Discrete Form, Function Comparison

When comparing the internal structure of a HIT vs. a discrete power transistor one would note the following similarities (Table-1) and differences (Table-2).

	Similarities	Comments
A	HIT uses same LDMOS DIE	HIT offers same "proven" reliability and performance as GOLDMOS discrete power devices.
B	MOS-Cap / bond wire matching structures	Very consistent device to device parameters such as insertion phase, forward gain, delay, phase linearity, and input match.
C	LDMOS source backside mounted directly to device flange.	Low Common Source inductance resulting in higher power gains. BeO or other interface between active die and flange not present allowing in low qj-c Thermal Resistance.
D	Gate bias may be adjusted .	Maximize RF performance to accommodate different modulation formats ie. CDMA, GSM, Multi-carrier. (see "HIT Biasing" section below.)
E	Vds (supply) voltage may be adjusted.	Higher P-1db may be obtained by increasing the Vds above the HIT's nominal value. The single stage HIT is specified at 28 volts nom. Two stage HIT specified at 26 volts nom. Like it's discrete counterpart the maximum operating Vds for the HIT = 32 Volts.

Table 1.

	Differences	Comments
A	HIT input and load impedance matched to 50 ohms.	Shorter system design cycle. Production tuning eliminated.
B	Internal bias network with temperature compensation.	Reduces complex system bias circuitry. External bias control may be implemented if required.
C	Ability of the HIT to have cascaded stages (multiple stage) within a single HIT device.	Greater system gain per given area of PCB real estate. System space savings.
D	More complex "on-board" circuitry possible due to hybrid design approach.	Distributed elements (microstrip stubs, lines) used on current HITS. Future "High Power " HIT offers quadrature splitter/combiners with internal input reject load.
E	Narrow RF and bias leads. (0.025 inch, 0.635mm.)	Easier soldering techniques possible in production due to smaller lead thermal mass.

Table 2.

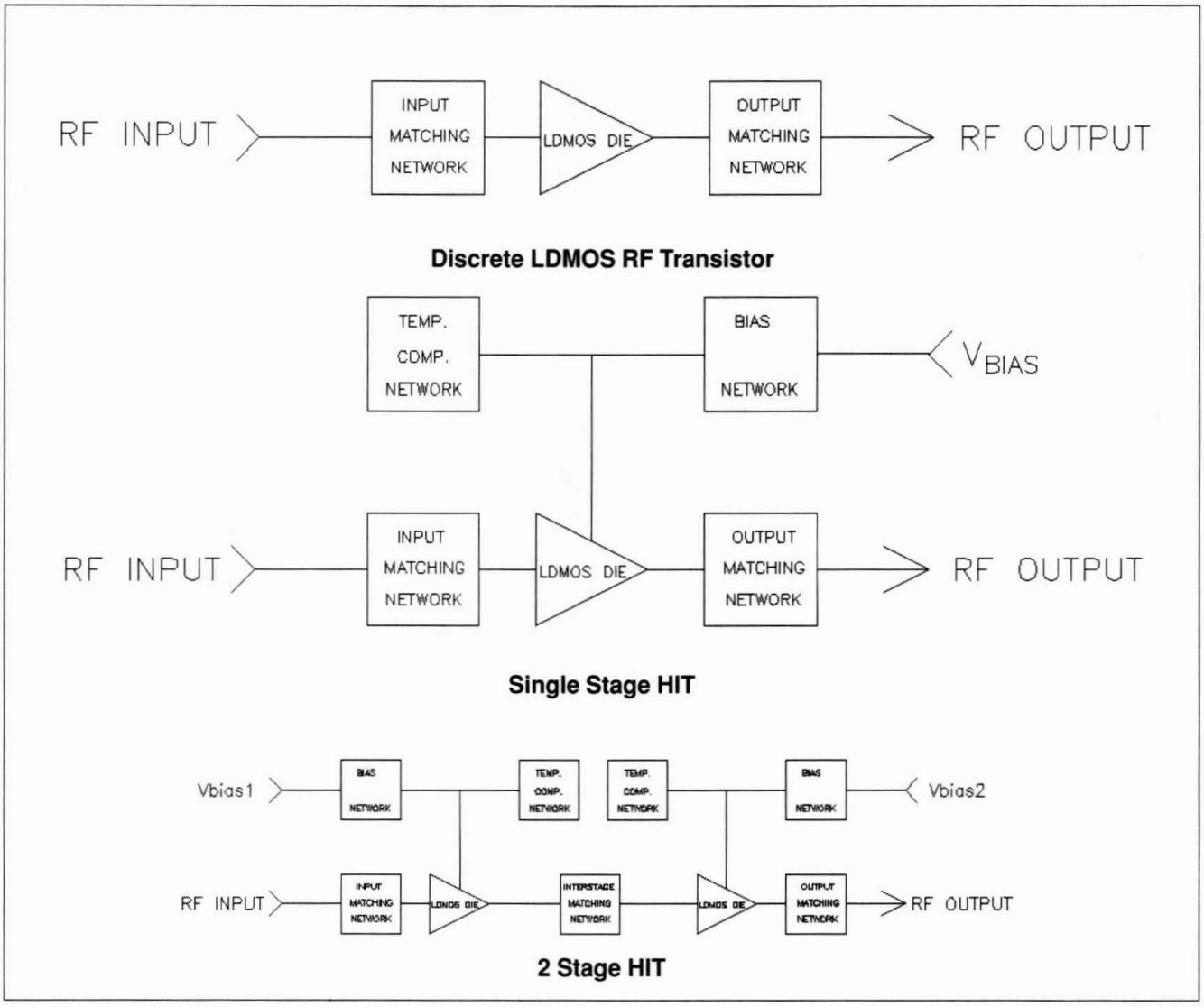

Figure 1. Functional Block Diagrams.

The comparison of the functionality of the HIT to the discrete RF power transistor is displayed below in Fig-!.

Note that the HIT has an internal gate bias network as well as internal temperature compensation in order to stabilize the operating point over temperature. This internal temperature compensation circuit is slightly under compensated, this compensation point was chosen for best IMD performance vs. temperature rather than maintaining a constant Id. over the entire temperature range.

The physical similarities of the RF matching topology between a discrete LDMOS RF power transistor and the HIT are obvious as shown in Fig-2 below. Since the LDMOS die is operated in the common source configuration, the die is directly attached to the flange of both devices, thus allowing for a short junction to case thermal path and offering lower common source inductance which improves gain and stability.

The chip and wire portion of the HIT's low-pass, input matching circuit is the same structure that is used in the discrete. The output structure for the HIT is a low pass network, which with chip and wire coupled with micro-strip elements matches the output to 50 W over the desired band. The discrete utilizes a shunt-L with a blocking cap to "tune out" the output capacitance of the LDMOS die in the band of interest.

Also note that "critical" RF ground return path which is located closer to the LDMOS die due to the low die impedance, is referenced to ground via the flange. PCB or other substrate ground vias are not used where higher RF currents are present (low-z matching structures located close to the active die), lower RF IR losses and greater device to device consistency is realizable. Repeatable HIT performance is also enhanced through the use of metal oxide chip capacitors and tight tolerance, computer controlled wire bond matching.

Mechanical outlines

The HIT is considered a Hybrid device. It contains chip and wire matching, as

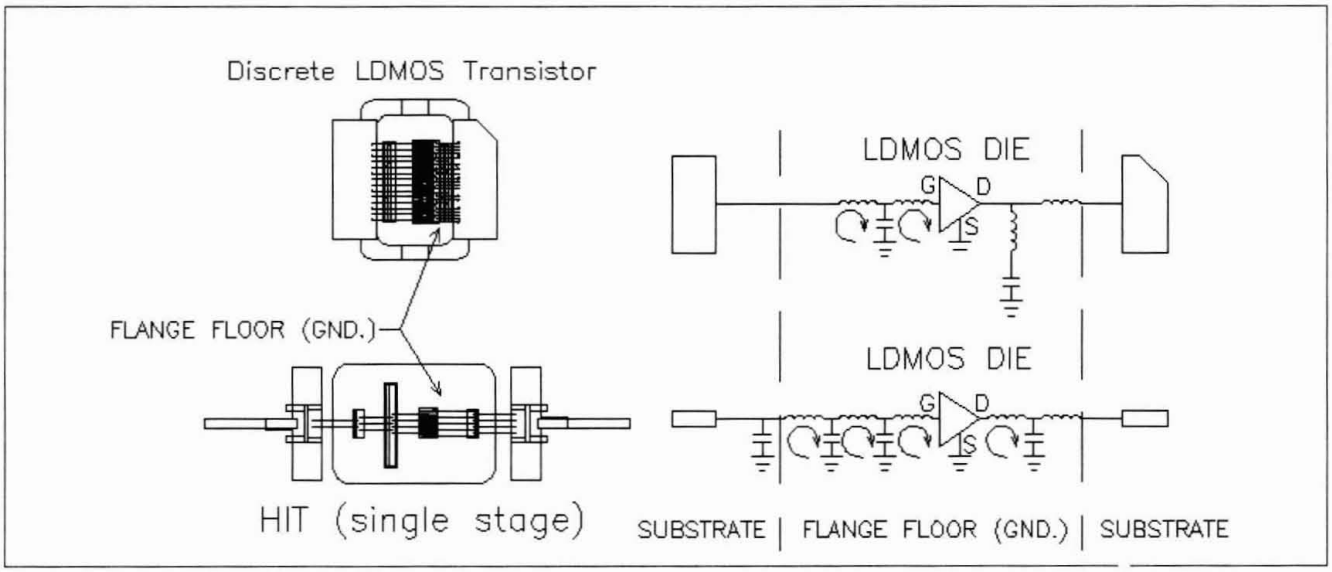

Figure 2.

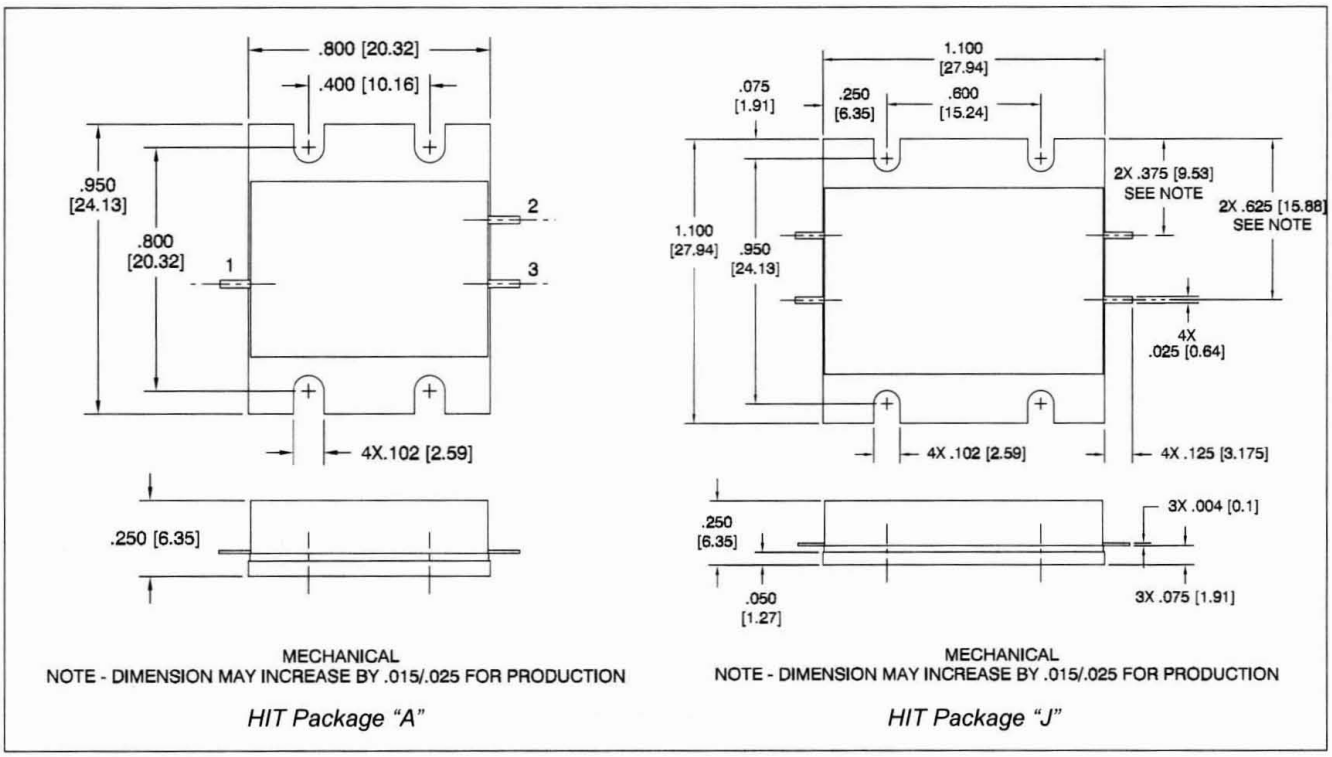

Figure 3. Mechanical outlines.

well as printed circuit microstrip lines. This dense packaging format eliminates the need for external matching circuitry; and gives a very small mechanical footprint for the overall amplifier. Figure 3 gives typical dimensions on the HIT products.

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Hit Biasing

Class AB amplifier biasing overview

When biasing an amplifier, consideration of the amplifier's dynamic range, the input signal waveform (modulation format), and desired output amplitude must all be considered. Note the transfer function shown in figure 4 and how an amplifier goes through three basic states as a signal is increased at the amplifiers' input. With a very low input drive signal, the amplifier operates in a "square-law" region, which will degrade the gain linearity (gain expansion) of the amplifier. The next transition is the linear or desired region. Best IMD and ACPR performance is obtained when the entire signal envelope is operated in this linear region. At the upper end of the transfer function the amplifiers' gain decreases as the input signal increases, thus called gain compression. The compression point sets the upper end limit of the linear dynamic range of the amplifier. As the peak to average ratio of the input signal is increased, the amplifier should be specified with higher output power which translates to a higher compression point. When an amplifier is intended for muti-carrier service in which higher degrees of linearity are required, the operating point or "quiescent point" is critical in minimizing the distortion. If the amplifier is biased such that the operating point is moved into the square law (bias region) end of the curve, higher IMD will be observed. If the signal is CDMA in nature with a high peak to average ratio degraded ACPR will also be noted when biased too low. This distortion is sometimes referred to as crossover distortion. To improve the IMD of the amplifier, the conduction angle should be increased by means of increasing the quiescent current. This would extend the dynamic range ("linear" portion) of the curve to accommodate for the lower average power levels used.

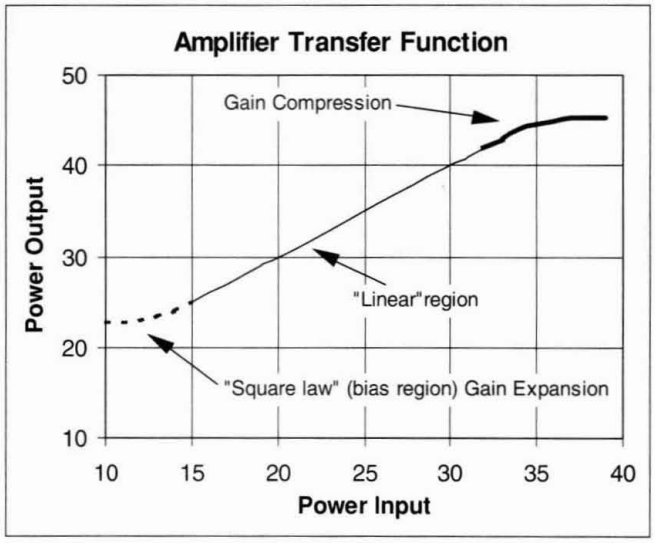

Figure 4. Amplifier Transfer Function.

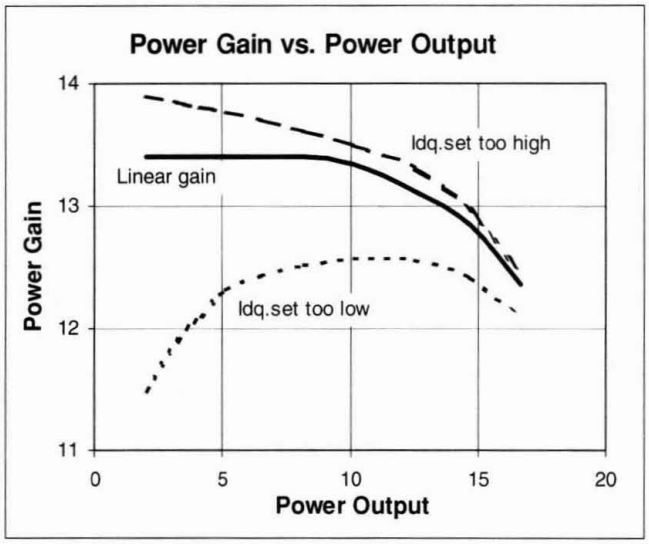

Figure 5. Power Gain vs. Power Output.

Single stage hit biasing

As the HIT is operated in a class AB mode, choosing the operating point is critical in maximizing the RF performance for a specific application. The single stage HIT requires a bias voltage of +12 +/-1.5 volts at approximately 25 mA. at the bias pin. The voltage is adjusted for the optimum Idq for best linearity for a given application ie. CDMA, GSM, or multi-carrier signal. The optimum bias point can measured with a power sweep (FIG-5), as well as with IMD measurements for multi-carrier testing, or ACPR measurements in a CDMA environment.

Two stage hit biasing

The 2 stage HIT contains two independent bias networks. Both stages require +8.0 volts at 25 mA. at each bias pin. The 2 stage HIT is preset internally so that if +8.0 volts is applied to both bias pins the device will produce "linear gain" vs. Pout (Fig-5). Setting the bias voltage of 8.0 volts will provide the best IS-95 CDMA performance with an average power level of approx. (P-1dB.-10 dB.). Example: The PTH 32003 has a P-1dB. of approx. 25-30 watts, with +8.0 volts applied to both bias pins(2-stages), best ACPR performance is obtained with an average power level of 2-3 watts. When using the HIT with a multi-carrier or CDMA signal which is "backed off" more than 13dB. from the P-1dB.state, bias of the second stage should be increased for optimum ACPR. Since the first stage is operated at a higher conduction angle than the second stage, deviating from the +8.0 volts setting of Vbias1 pin will not improve the linearity. The second stage bias setting has greater influence on IMD and ACPR performance. Higher device gain may be achieved by increasing the bias voltage at the expense of linearity.

A performance comparison with different bias voltages applied at the Vbias2 pin is shown in fig-6 and Fig-7. A 2-tone (3dB. peak/ave. ratio) and a CDMA signal were compared. Note as

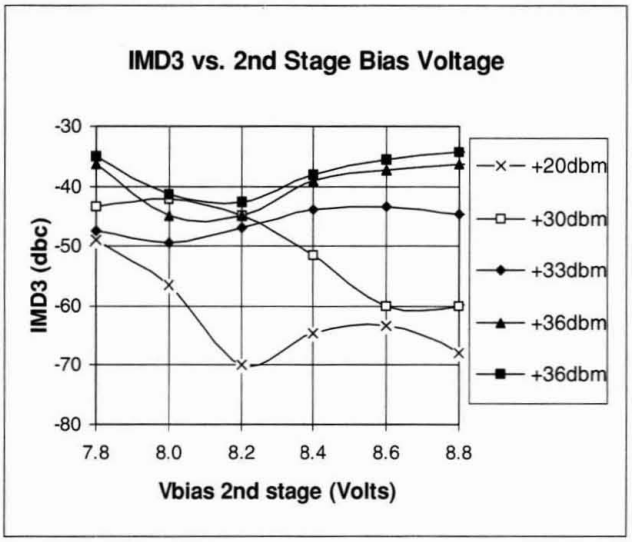

Figure 6. IMD3 vs. Second Stage Bias Voltage.

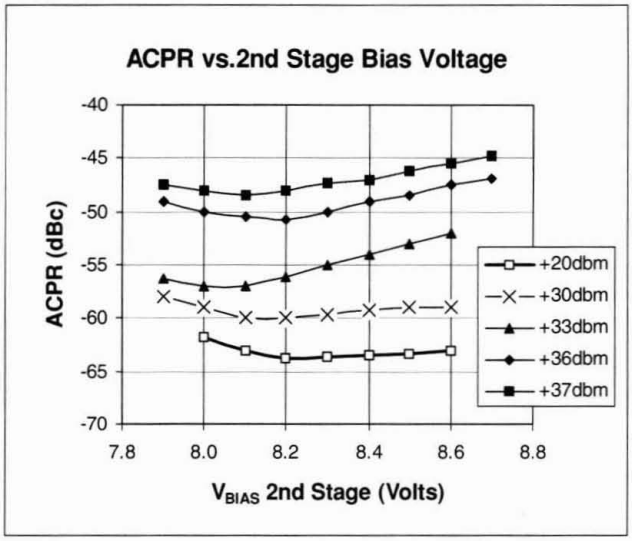

Figure 7. ACPR vs. Second Stage Bias Voltage.

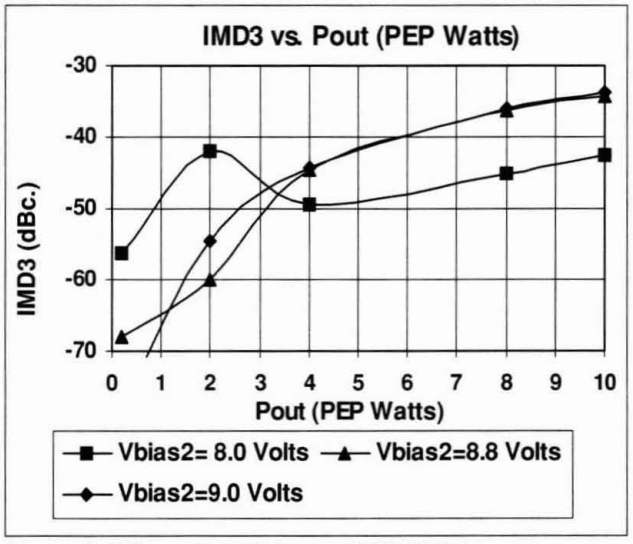

Figure 8. IM3 vs. Output Power (PEP Watts).

stated above that the "best" performance is measured at 8.0 volts applied at the Vbias2 pin for an average power output of approximately +33dbm. This corresponds to a 10 dB back-off from P-1dB.

Another graph was generated comparing 2-tone IMD3 vs. Pout (PEP) for the PTH 32003 2-stage 25 watt HIT as shown below in figure 8. It can be noted that at approx. 3.25 watts PEP (1.625 watts average) the bias points converge resulting in IMD3 of approx. –48dBc. at any bias level from 8.0-9.0 volts. Below the 3.25 watt PEP level improvement of IMD3 is apparent by increasing the quiescent current of the second stage by means of increasing the Vbias2 voltage greater than 8.0 volts. When operating the PTH 32003 HIT from approx. 3.25-30 watts PEP a bias setting of 8.0 volts produces lower third order products. IMD3 was typically measured at –30 dBc. with the Vbias2 setting of +8.0 volts, Vsupply at +26 volts, Fc of 1.93-1.99 GHz., and an output power of 30 watts PEP.

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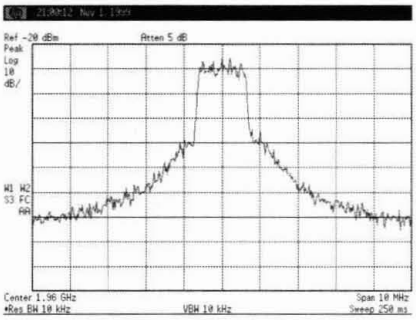
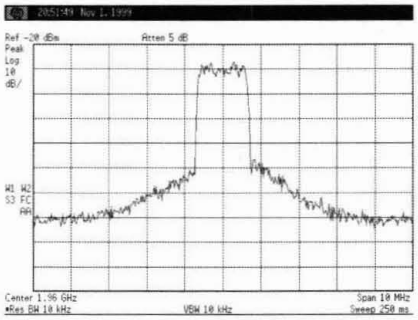
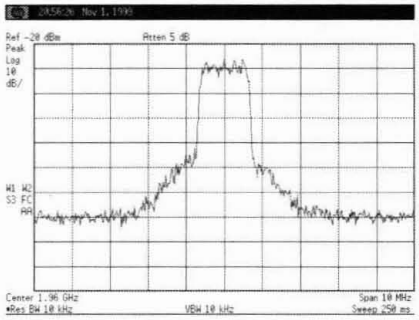
Shown on the next page in Figure 9 are 3 CDMA measurements with 3 voltages applied in 0.5volt increments to the second stage bias pin. The PTH 32003 tested was operated with an average power out of +33dBm (2watts). The optimal ACPR performance is obtained with a Vbias2 pin setting of +8.0 volts is maintained.



+33dbm.Ave.Power
Vbias2=7.5 Volts



+33dbm.Ave.Power
Vbias2=8.0 Volts



+33dbm.Ave.Power
Vbias=8.50 Volts

Multi-carrier measurements

The PTH 32003 was tested with 15 phase-synchronized tones at an average power output of +20dbm and +30dbm. As 15 tones represents a 11.76 dB. peak/avg ratio, the peak power of both test signals was approximately 1.5 watts and 15 watts respectively. The bias voltage of the second stage was set at 2 points, a "standard bias" of +8.0 volts and a "high bias" setting of which the "best" performance was noted. Note that in the +20dbm average power test an improvement of the 3rd order component of approximately 23 dB was achieved by increasing the quiescent current of the second stage (fig-10b). The test was repeated with the +30 dbm average signal (15 watts peak) at the output. Note that in fig-11b only approx. 4-5 dB. of improvement was measured by increasing the bias of the second stage at this +10 dB output power level. This test corresponds to the 2-tone test in fig-6 in which the +30dbm (2watts PEP) required an increase in bias. Here in the multi-carrier test at an average output power of +20dbm (1.5 watts PEP) the second stage bias current was increased for improved IMD performance. When a portion of the signal occurs in the "square law" bias region of a class AB amplifier (Pout backed off past the linear portion of the dynamic range) degradation of the IMD will occur due to gain expansion. Increasing the bias current, which in turn increases the linearity is necessary.

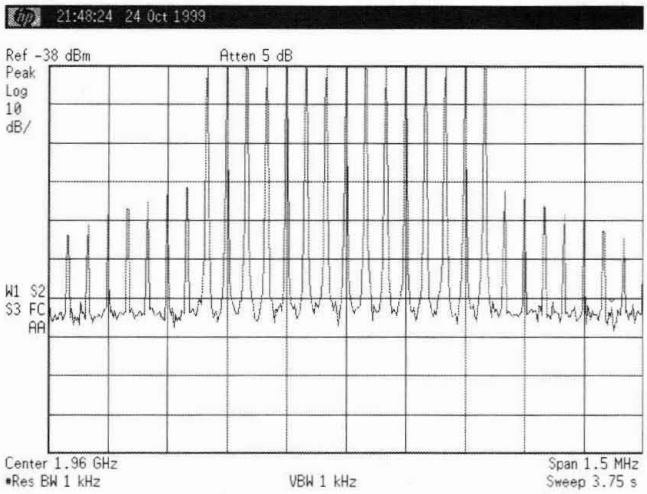


Figure 10 "A".

15 Carriers
+20dbm. Ave. (1.5 Watts PEP)
PTH 32003 "standard bias"
Vsupply =+26 volts
Vbias1=8.00 Volts, Idq1=270 mA.
Vbias2=8.00 Volts, Idq1=450 mA.

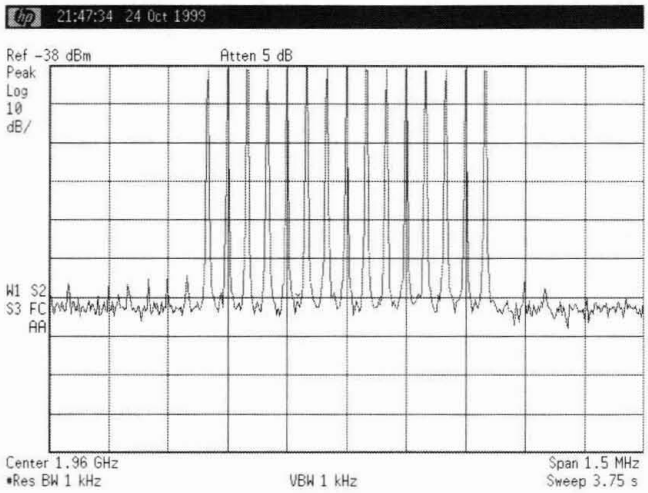


Figure 10 "B".

15 Carriers
+20dbm. Ave. (1.5 Watts PEP)
PTH 32003 "high bias"
Vsupply =+26 volts
Vbias1=8.00 Volts, Idq1=270 mA.
Vbias2=8.80 Volts, Idq1= 800mA.

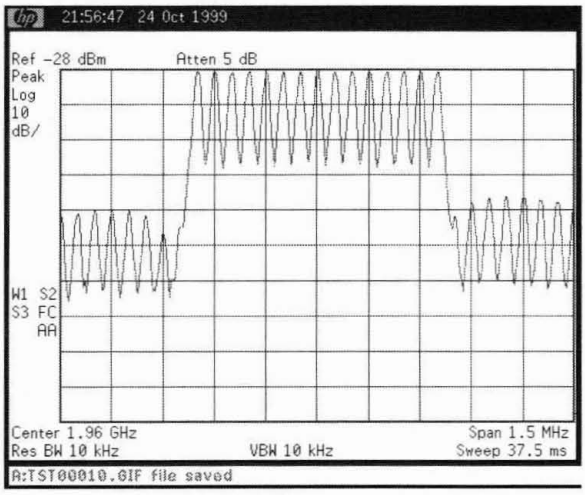


Figure 11 "A".

15 Carriers
+30dbm. Ave. (15 Watts PEP)
PTH 32003 "standard bias"
Vsupply =+26 volts
Vbias1=8.00 Volts, Idq1=270 mA.
Vbias2=8.00 Volts, Idq1=450 mA.

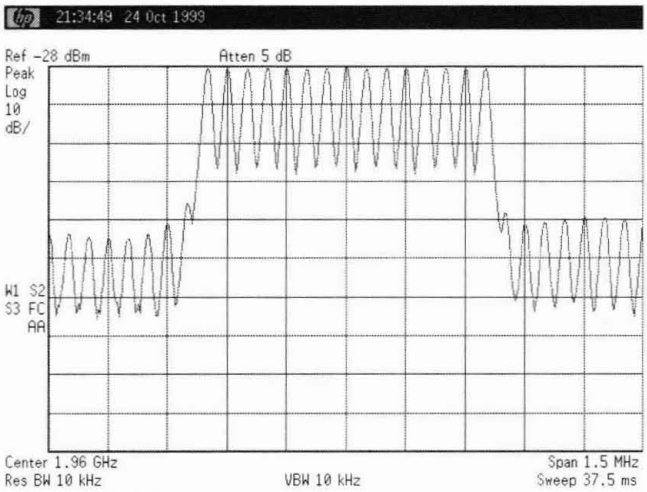


Figure 11 "B".

15 Carriers
+30dbm. Ave. (15 Watts PEP)
PTH 32003 "high bias"
Vsupply =+26 volts
Vbias1=8.00 Volts, Idq1=270 mA.
Vbias2=8.80 Volts, Idq1= 800mA.

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Hit circuit

The circuitry which surrounds the HIT is quite basic. Since the HITS' input and load impedances are 50 ohms, the corresponding transmission lines must also be 50 ohms. Even though external bypassing of the bias leads is shown, the HIT has an internal RF bypass at the bias feed point. Additional external bias bypassing is not critical. The most important part of the circuit which influences performance is the Vds (Vsupply) bypassing. Located at the cold end of the Vsupply quarter wave transmission line DC feed are two capacitors. The first of these is an RF bypassing capacitor which was selected for resonance in the 1800-2000 MHz band. When multiple carriers are amplified non-linearities in the device will generate "mixed" products at the output circuit which will degrade the amplifiers IMD performance unless properly bypassed. Above 200 KHz. through 15 MHz. the 0.1 uf. also located at the cold end of the Vsupply quarter wave transmission line plays an important role in suppressing mixed products in this band. At low bandwidths (0-200 KHz.) the DC supply feed offers a low impedance to ground via. the RFC (6 turn coil) and the 220uf. electrolytic capacitor. When proper bypassing is utilized, superior IMD performance at wide bandwidths can be realized. Typical test circuits for single stage and 2-stage HITS are shown in Fig-12 below.

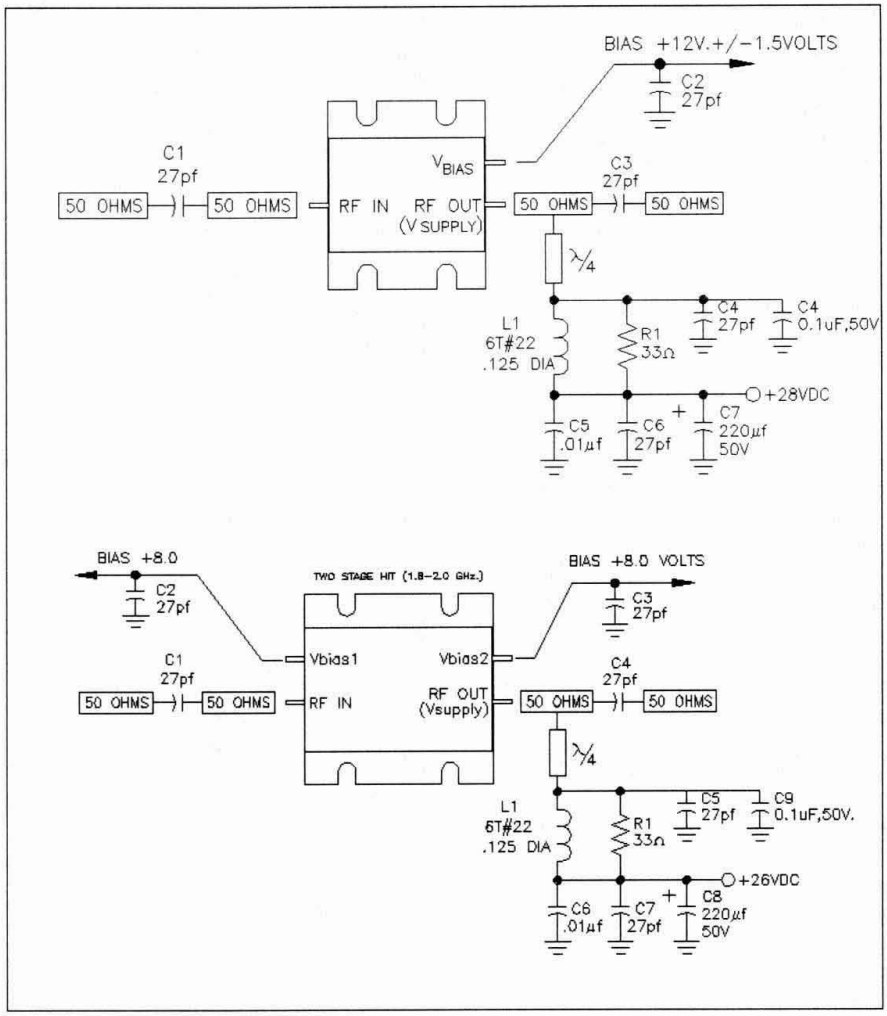

Figure 12.

Hit line-ups

Shown below in Fig.13 are typical line-ups that utilize the single stage and the high gain 2-stage HITS. Note that the HIT can be used as a driver for a discrete transistor gain stage. Since the HIT requires a 50 Ω load, an isolator can be used between devices to minimize interaction between the stages. In all other cases in which the HIT drives a 50 Ω load the circuit becomes quite simple.

Conclusion

Implementing the ERICSSON HIT in a system can significantly reduce design time and increases production through-put with consistent performance. The same HIT may be used for AM, FM, CDMA, GSM, or multi-carrier applications. The HIT is particularly well suited for space limited applications. Setting up the proper bias point can maximize the HIT performance depending on the modulation format, and peak to average ratio.

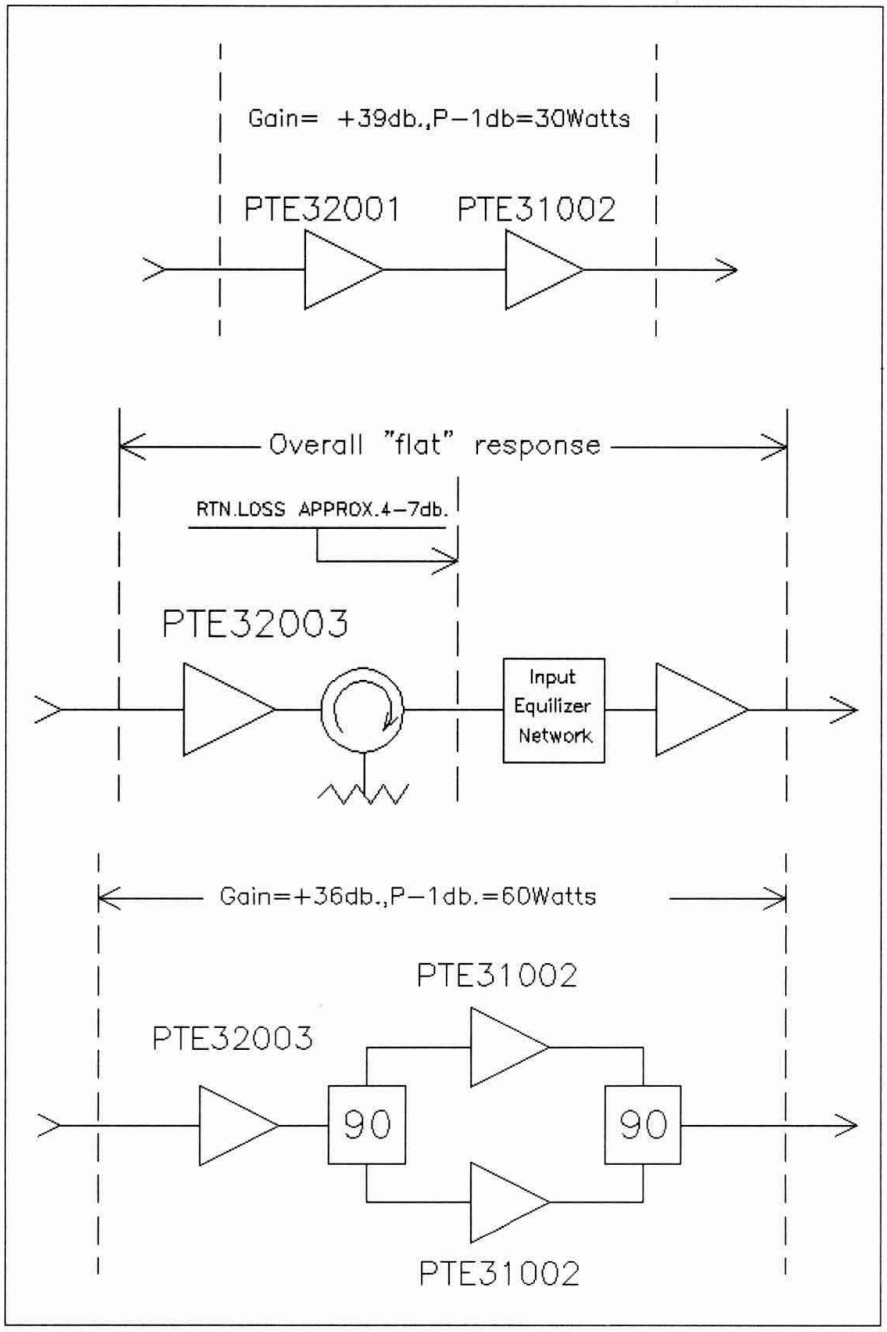

Figure 13.

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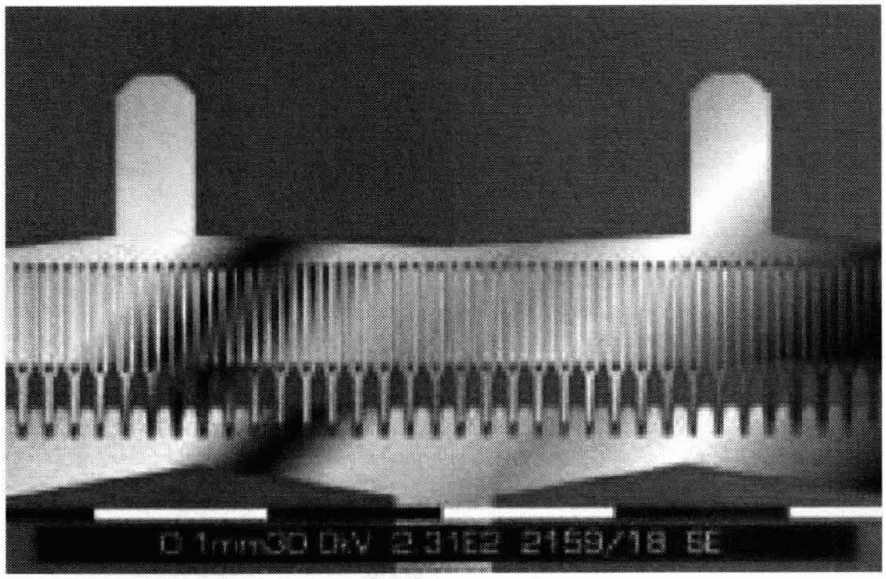
Gold: A Strategic Choice!

by Ted Johansson and Jim Curtis, Ericsson Microelectronics, RF Power Products

Introduction

The purpose of this paper is to discuss advantages and disadvantages of gold metallization used on RF-power devices, its impact on device performance and reliability from a user's perspective. The paper also provides insight into design tradeoffs associated with metallization from a manufacturer's point of view. This paper includes information about Ericsson's metal system, and problems solved to supply very reliable, high power microwave transistors.



Today, nearly all silicon semiconductors use aluminum metallization because it is easy to deposit and pattern, forms stacked layers that can be isolated for crossings required by ICs, and can be manufactured in high volume with high yield. Over the years, most shortcomings have been reduced or eliminated, and until recently, there was no serious replacement (IBM introduced a copper-based system for metallization of very large scale, high-speed ICs in 1997).

Silicon RF-power devices, however, represent an exception due to their high conductor current density and high junction (metal) temperature. These devices converted to gold systems in the early 1970s when metal migration was found to cause failures. Since then, the superior properties of the gold metallization have made this metallization scheme the primary choice for RF-power.

Aluminum metallization was recently discussed for use on RF Power transistors [1]. One reason for renewed interest is that improved device performance at higher wireless frequencies is primarily addressed by reducing device dimensions. This is especially true for Laterally Diffused MOS (LDMOS) transistors, where lateral dimensions significantly impact frequency performance, and requires the most demanding processing today. It is generally believed that gold metallized devices must be produced in isolated areas because gold potentially damages semiconductor properties. Cost of a dedicated fab for these relatively low-volume RF products is high. Also, the existing gold metallization schemes are harder to scale. It may therefore be tempting to convert the metallization system to something similar to what is used for ICs, i.e. aluminum. Manufacturers could then process LDMOS in state of the art, high volume CMOS fabs. However, as we shall see, it undoubtedly leads to some compromises regarding device performance and reliability.

Why gold is preferred for RF Power

The first RF-power devices were developed during the 1960s. As electrical performance improved in the early 1970s, reliability problems appeared. Narrow metal stripes associated with tighter geometries combined with high current densities associated with increased output power caused electromigration failures. The solution was to switch from aluminum to gold-based metallization systems having much greater resistance to electromigration.

Electromigration is the transport of metal ions through a conductor [2]. At high current densities, there is significant momentum transfer from electrons to metal atoms. This removes metal from the highest current density point in the conductor which increases conductor resistance and further increases current density. Ultimately, it leads to an open conductor. Electromigration is among the most widely known and extensively researched failure mechanisms for ICs. High temperature and high current density make it easier for metal ions to electromigrate. Resistance to migration depends on conductor properties such as atomic weight, melting point and grain structure. It also depends on dimensions of the structure, and on layers under and on top of the conductor.

Examining material properties of gold and aluminum reveals that gold has a very high atomic weight (197) compared to aluminum's (27). This, together its high melting point of 1063 °C compared to 658 °C for aluminum, makes gold extremely resistant to electromigration. Other properties also favor gold over aluminum: resistivity is 18 % lower, thermal conductivity is 36 % higher, and coefficient of thermal expansion is 40 % lower.

All metallization systems require a good barrier to prevent diffusion into silicon. At 370 °C, gold and silicon form a eutectic alloy, which leads to leaky and shorted junctions. Aluminum and silicon withstand a somewhat higher temperature (alloy forms at 577 °C). At lower temperatures, however, aluminum also mixes into silicon causing problems with junctions and contacts. Adding silicon to aluminum reduces the problem, but adding a barrier layer (e.g. TiN) is preferred.

A metallization system must adhere to underlying materials (e.g. silicon dioxide). Aluminum atoms adhere to oxide, while gold requires an additional layer to ensure good adhesion. Most gold metallization systems use the diffusion barrier to meet this additional requirement. For example, Ericsson's gold system uses TiW(N) both as a barrier and an adhesion layer.

Reliability of metal interconnects is often determined by lifetime experiments on a set of metal lines. Lines are stressed at high current densities (typically 10^6 A/cm^2 or greater) and at elevated temperatures (150 °C to 250 °C). Time to failure (common criteria is open for single-layer structures, or 20 % increase in resistance for multi-layers) is plotted on a lognormal graph, and values of T_{50} (time for 50 % of the samples to fail) is extracted together with the standard deviation. The general expression, first proposed by Black [3], for mean time to failure (MTTF) is:

$$MTTF = A\, J^{-n} \exp(E_a/kT)$$

where

A = material constant based on microstructure and geometric properties

J = conductor current density in A/cm^2

n = constant whose value ranges between 1 and 3 (2 is often used for aluminum)

E_a = activation energy (eV)

k = Boltzmann constant

T = temperature (K)

Constants *A*, *n* and E_a are determined to predict conductor lifetime at any current or temperature. This requires T_{50} data at three different temperatures and three different currents (three conditions confirm acceleration results from a single failure mechanism). Most experimenters use standard test structures, so their results, when carefully reported, are useful to others. Based on generally accepted values from the literature, gold metallized, 2 GHz RF-power transistors have roughly 100 times longer MTTF than similar aluminum metallized devices.

Electromigration is not the only mechanism affecting transistor lifetime. Contacts to the semiconductor can migrate at high currents, so this interface must also include a barrier layer that prevents metal from mixing with the semiconductor (see above). A semiconductor device itself may degrade. For example, threshold voltage (V_{TH}) drift caused by hot carrier injection is the most serious for LDMOS, while degradation of bipolar power devices is not common under normal operation conditions. Other material related degradation generally accelerates exponentially as a function of temperature. They may, therefore, impact RF-power devices that often operate at higher temperatures than ICs. It is important to assess reliability under worst case, high temperature conditions. Gold's better thermal conductivity helps spread heat, and its lower electrical resistance reduces dissipation, thus lowering junction and conductor temperatures.

Changing viewpoint from chips to packaged devices, an all-gold system has significant advantages. Aluminum metallization leads to potential problems associated with bondwires and the intermetallic interface between aluminum and gold. Taking the interface first, *purple plague* ($AuAl_2$ intermetallic formation) results from long-term Al-Au mixing that makes metal brittle and ultimately fail. It is more pronounced at elevated temperatures. Nearly all RF-power devices use gold-plated packages so aluminum and gold are automatically mixed. This problem is completely avoided if transistors use gold metallized chips and gold bondwires. When a die has aluminum metallization, selecting a low-temperature gold-aluminum interface minimizes purple plague.

For example, it is better to bond aluminum wire to a gold plated package rather than gold wire to the hotter aluminum metallized transistor chip.

Aluminum bondwires, however, lead to additional problems. Aluminum has higher electrical and thermal resistance than gold so it has higher ohmic loss and reaches a higher temperature. Further, its thermal expansion coefficient is higher than gold's. This causes problems when amplifying signals having time varying waveforms. Wires heat and cool in response to a signal's amplitude resulting in wire movement that causes fatigue. Failure occurs when a wire's ends work harden. Under some circumstances, failure occurs in just a few months. Gold's lower thermal and electrical resistance, lower expansion coefficient and better malleability combine to make it very resistant to wire fatigue.

Finally, since aluminum is chemically active, some failures occur when it reacts with oxygen or contaminants. A reaction is more likely to occur at high temperature. For example, bond wires connecting a chip's output terminals to a package or output capacitor are generally hotter and therefore more likely to react (oxidize). Oxidation reduces a wire's current handling capacity, further increasing temperature and tendency to react. Eventually, wires may melt. In comparison, gold tolerates contaminants, and its higher thermal conductivity results in lower temperature. Both are significant advantages.

What makes gold difficult

From the manufacturer's point of view, many semiconductor processing steps available for aluminum do not work well with gold due to chemical differences. The main problem is patterning a deposited gold layer. Line widths less than 1-2 µm are difficult to define. In contrast, manufacturers routinely etch sub-micron aluminum lines. Since metallization occurs at the end of processing, control problems that cause low yield are very costly. Such problems may result in

scrapping otherwise perfect wafers just prior to completion.

Solving gold's processing problems

Ericsson Components developed a patented high-reliability, high-yield, gold-based metallization system using sputtering, electroplating, and wet and dry etching [4]. The system is used for all the bipolar and LDMOS RF-power transistors as well as for chip capacitors used for internal matching. Processing is carried out in a dedicated fab area. Multi-layer TiW/TiW(N) is used to ensure a good diffusion barrier between gold and semiconductor materials. Adding nitrogen (N) during sputter deposition greatly enhances barrier lifetime. Tests predict a lifetime (i.e. time when 5 % of the devices fail) of 2600 to 4800 years at 130 °C, or more than 1700 years at 200 °C.

The process starts with a thin gold layer sputtered onto the TiW barrier. Photo resist is applied and G-line stepper technology produces sub-µm dimensions. Then, a special plating machine electroplates between 0.7 to 3 µm thick gold (thickness depends on product type) onto regions not covered by photo resist. Resist is then removed, and the thin film gold is removed using a proprietary wet etchant. The TiW barrier is then dry etched using reactive-ion etching (RIE). The result is a high quality gold-based system having good process and dimensional control, high yield, and high reliability.

Conclusions

Use of gold for RF-power transistor metallization and interconnects was discussed and compared to aluminum-based systems. Facts and field experience favor gold over aluminum for RF-power transistors. Although more demanding to master, all-gold metallization systems resist migration, ensure integrity of interconnects and avoid problems associated with mixing metals in transistor packages. Ericsson believes this strategic choice results in maximum performance and reliability for the most demanding telecommunications applications.

References

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[2] C. Y. Chang, S. Z. Sze, Ed., ULSI Technology, McGraw-Hill, 1996.
[3] J. R. Black, "Electromigration Failure Modes in Aluminium Metallization for Semiconductor Devices", Proc. IEEE, 57, 1587 (1969).
[4] S.-H. Hong, US Patent 5,821,620.

Gold metallization - three methods summarized

Evaporation and lift-off

Very popular for GaAs devices. Often combined with electroplated *air-bridges* to form crossings between islands of metal. Process steps are quite demanding. Evaporation systems that deposit metal on large diameter wafers must themselves be very large (large working distance prevents shadowing effects). Thick photo-resist must be applied to ensure correct lift-off, and this involves use of special resists or additional processing. Available metals for this method are limited. Typical material combinations are Ti/Pt/Au or Ti/Pd/Au. Material losses are quite high since only roughly 10 % of deposited gold is actually left on wafers. Sub-micron dimensions, however, are possible.

Sputtered metal stack with ion milling etching

Method preferred by most silicon RF Power transistor vendors. Sputtering is relatively straightforward. The most demanding step is ion milling, a non-chemical dry etch system having less process control than comparable etching steps in silicon processing. Yield can be a problem and gold waste is similar to the lift-off method. Difficult to achieve dimensions less than 4 µm. Limited Au thickness and aspect ratio because of problems with re-deposited Au particles.

Sputtering and electroplating with removal by deplating or wet etching

Some critical steps during plating and removal of thin sputtered gold needed for plating, and during barrier removal. When mastered, however, a very good metallization process having little wasted gold. Capable of smaller dimensions than the sputter/ion-mill process, but not as small as the lift-off process.

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GOLDMOS™ Device Modeling

Prepared by Cindy Blair, Ericsson Microelectronics, RF Power Products

Over the past year Ericsson Components has begun developing Device Models for select LDMOS products. The first models began "Beta" testing in August of 1999. Initial testing of the models has been done in ADS and standard Spice3 simulators. Scheduled improvements for year 2000 are an enhanced capacitance model, and modeling of thermal effects.

Figure 1 shows the LDMOS portion of the Ericsson model. *M1* is the UCB MOS LEVEL3 MOSFET, representing the channel region in LDMOS. *Z1* is the Statz model of MESFET, representing the drift region in LDMOS. *D1* is the standard diode model, representing the drain-substrate/source diode and substrate network. All other symbols have their conventional meanings. In the actual device model the above parameters would be scaled in accordance with actual die geometric parameters, and total active area. Passive elements such as package elements, bond wires, and matching components would also be added to the finished model.

Our modeling teams based in Kista, Sweden, and Morgan Hill, California are continuously updating and improving these models. The actual device models available are limited, but that list is expanding. Due to the preliminary nature of these tools, and to ensure that you receive the latest models available, please contact your Ericsson sales professional regarding availability.

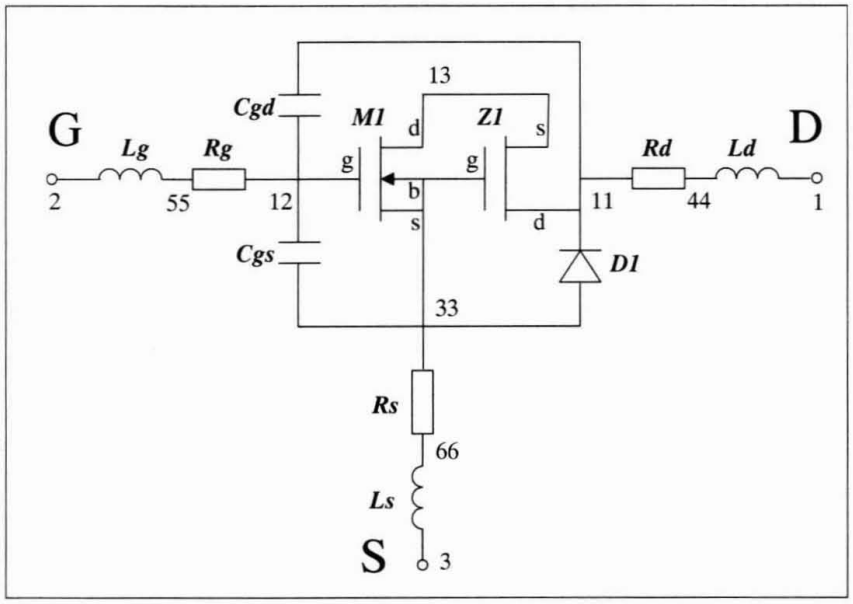

Figure 1.

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A Scalable LDMOS Amplifier for Digital Audio Broadcast

Prepared by Cynthia Blair and Henrik Sjoden, Ericsson Microelectronics, RF Power Products

Over the last few years two new applications requiring high linearity have surfaced for wireless communications, and broadcasting around 1.5 GHz. The Japanese Personal Digital Cellular System (PDC) has been moving towards multi-carrier base stations. The new L-Band Digital Radio Broadcasting Services (DAB) utilize a COFDM signal. Aside from the frequency of operation, these two systems share many other commonalties. In summary:

1. In both cases, low intermodulation distortion (IMD) is of paramount concern.
2. Due to the low IMD requirements, a feed-forward correction loop is likely to be part of the system.
3. Both signals will have very high peak-to-average ratios.

   In the case of the PDC multi-carrier signal, the following ratio applies:

   Peak Power = n^2 * Pk

   where "n" is the actual number of digital carriers being broadcast and "Pk" is the peak power of one of these digitally modulated carriers. (The assumption is made that all carriers are of an equal level.) In most systems "n" would equal 8 or 16.

   The Eureka-147 based DAB COFDM signal consists of the superposition of a large number of carriers, from 192 to 1536 depending on the mode, each phase modulated by a different bit stream. These carriers (fortunately) are not all present, or at peaks, simultaneously. The largest peaks are on the order of 29 dB for this type of signal. However, as these peaks almost never occur from a statistical standpoint, we can design a reasonable, cost effective amplifier if we target a lower peak-to-average ratio determined principally by the allowable spectral regrowth.

A scalable amplifier system including some low-level drive, final and (possibly) error amplifier building blocks will be described. The amplifier(s) will be suitable for either a DAB or a multi-carrier PDC system. The design parameters were governed by the required DAB spectral mask for Eureka-147, and by what could reasonably be expected from a feed-forward correction system. The Ericsson PTF 10125 (figure 1) 1.4–1.6 GHz, 135 watt (150 typical) LDMOS transistor was chosen for the final amplifiers. The PTF 10125 is an internally matched, common source N-channel, push-pull, lateral DMOS device. The internal die structure is made up of 72 cells, each cell containing sixty 0.8-micron gates.

The Ericsson PTF 10021 (figure 2) 1.4–1.6 GHz, 30 watt LDMOS transistor was chosen for the driver and error amplifier applications. An amplifier intended for use in a feed-forward error correction system must have very flat amplitude and group delay response over the desired bandwidth, making the PTF 10021 particularly well suited for this application. The internal matching structures on the input and output of this device will help facilitate the design of a simple broadband circuit with excellent gain and phase flatness. The PTF 10021 is also a common source N-channel lateral DMOS device. The internal die structure is made up of 18 cells, each cell containing sixty 0.8-micron gates.

Both the PTF 10021 and the PTF 10125 utilize *GOLDMOS™* technology for ultra reliability. It has been well known for decades that gold is the metallization of choice in any high power, high frequency application.

To combine the amplifiers in the final system, "off the shelf," low loss, 90° combiners will be used. The starting system design goals are:

1. Small signal gain, 20 dB or higher.
2. Frequency range, 1.45 – 1.513 GHz.
3. Flatness across band of interest, ±.25 dB.
4. Two tone IMD, ≤-41 dBc @ 6-24 W PEP @ Δf .01-10 MHz.
5. DAB spectral regrowth ≤-30 dBc @ 60 W DAB
6. All components to be surface mount, with the exception of the RF devices.
7. Dual quadrature, combined devices are preferred for minimum response perturbations due to mismatches in the system.
8. Phase vs. frequency should be as flat as possible.

In order to achieve this performance, the final amplifiers must provide at least the same level of bandwidth, IMD and re-growth performance as the system specification. The driver / error amplifiers must have a wider bandwidth (1.4–1.6 GHz) so that phase vs. frequency over the band of interest is extremely flat. In order to achieve this flat group

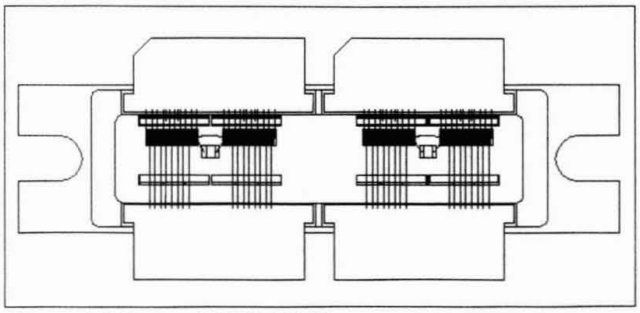

Figure 1. Ericsson's PTF 10125.

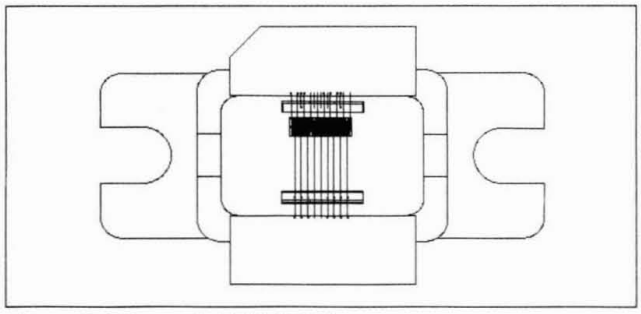

Figure 2. Ericsson's PTF 10021.

delay response the amplifier should be targeted for a wider bandwidth than needed. Our amplifier must actually only perform in the 1.45–1.513 GHz range to cover both desired services. However, the targeted response for the driver/error amplifier will be 1.4–1.6 GHz for reliably flat group delay characteristics. The final amplifier will have a targeted response from 1450–1550 MHz.

Device impedance data from the Ericsson data sheets provided the starting point for the design of the matching networks. Circuits were designed using microstrip elements and chip capacitors. In the case of the PTF 10125, a perfect balun on the input and output was assumed for simulation purposes. These "rough" circuits were then simulated in =SuperStar=™ for the optimal response across the band of interest. A circuit with a single device was fabricated and minor value adjustments were made for optimal performance over the band. Figure 3 shows the microstrip and bypass values after bench optimization for a single PTF 10021 device. Figure 4 illustrates the transfer characteristic of the amplifier at mid-band. Figure 5 shows gain vs. frequency.

Two nearly identical circuits were designed for the PTF 10125. One used a conventional semi-rigid coaxial balun, the other used an experimental balun obtained from RF Power Components. Both circuits performed comparably; the only differences were ease of manufacture and circuit size. Figure 6 shows the microstrip and bypass values after bench optimization for a single PTF 10125 device.

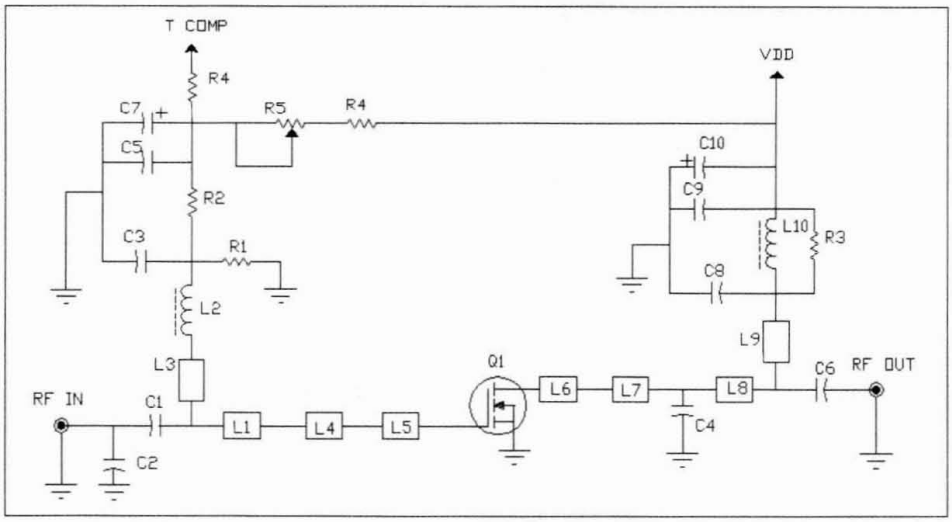

Figure 3.

L1	Microstrip 30 W .028 l1.5 GHz	L10	Ferrite 4mm.
L3	Microstrip 70 W .084 l1.5 GHz	R1, R2	Resistor 220 W
L4	Microstrip 30 W .092 l1.5 GHz	R3, R4	Resistor 100 W
L6	Microstrip 11.7 W .089 l1.5 GHz	R5	Potentiometer 2KW
L7	Microstrip 21 W .059 l1.5 GHz	C1, C3, C6, C8	Chip Cap 33pF
L8	Microstrip 21 W .026 l1.5 GHz	C2	Chip Cap 0.9 pF
L9	Microstrip 70 W .250 l1.5 GHz	C4	Chip Cap 0.7 pF
L11	Microstrip 11.7 W .048 l1.5 GHz	C5, C9	Chip cap .1 µF
L2	Chip Inductor 2.7 nh	C7, C10	Capacitor (Tantalum) 10 µF

Figure 7 shows the transfer characteristic of the single PTF 10125. Figure 8 gives amplitude vs. frequency response for a single PTF 10125 in our circuit. Figure 9 provides 2-tone IMD data. Additionally, pulsed measurements were done to ascertain compression levels at high pulsed powers (figure 10).

LDMOS devices inherently have two distinct advantages thermally. First, the lateral structure of the FET die ensures greater thermal spreading than with the equivalent vertical structure. This structure also brings the source to the bottom side of the silicon chip, eliminating the need for any non-conductive thermal substrate such as Beo, and allowing for a direct low thermal resistance

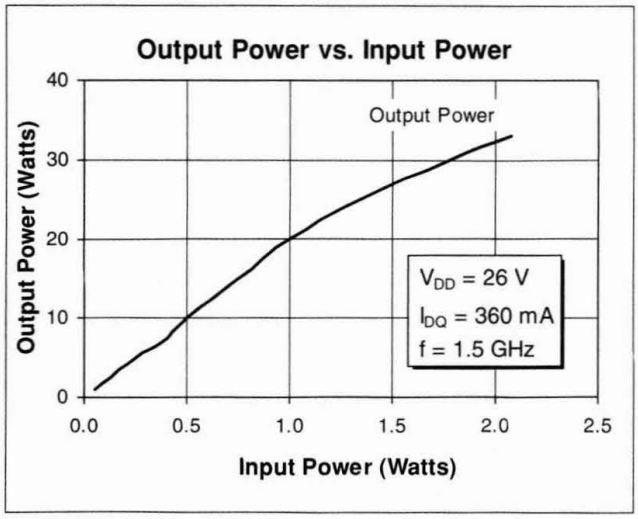

Figure 4.

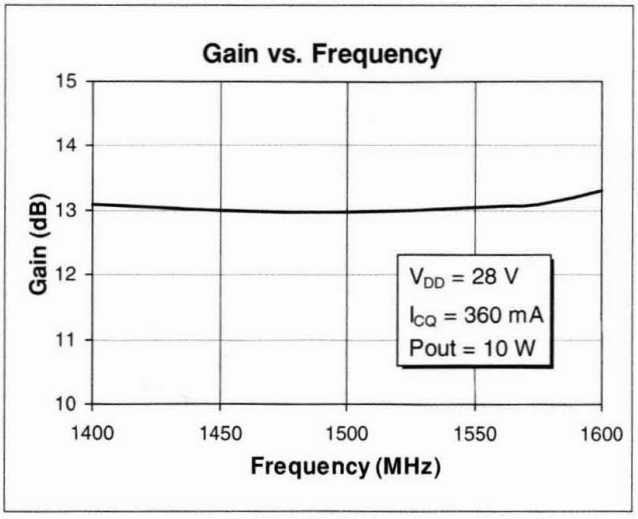

Figure 5.

chip-to-flange attachment. Secondly, at high currents the FET has a negative temperature coefficient. As temperature increases, the Gm drops. This will certainly keep the devices safe from destructive thermal runaway, giving the designer one less thing to worry about. However, at lower currents FETs have a positive temperature coefficient. In the case of the PTF 10021 the crossover point (from positive to negative temperature coefficient) occurs at about 2.6 amperes of drain current. In the case of the PTF 10125 crossover occurs at 10.4 amperes. This amplifier is intended to operate at a significantly backed off level: our projected current draws are around 6 A for the PTF 10125, and 800 mA for the PTF 10021. Any measurement of the temperature vs. IDQ and gain characteristics should be done at drain current levels approximating the actual operating power, and any standard thermal compensation should be set up in accordance with the parameters above. For this application, an LM335 temperature sensor was thermally linked to the heat sink; its buffered output provides subtractive thermal compensation through a weighted resistive adder.

The Driver/Error Module was tested at 3 watts DAB power. This number was determined to be the maximum power that the driver would need to produce in either of the test DAB systems.

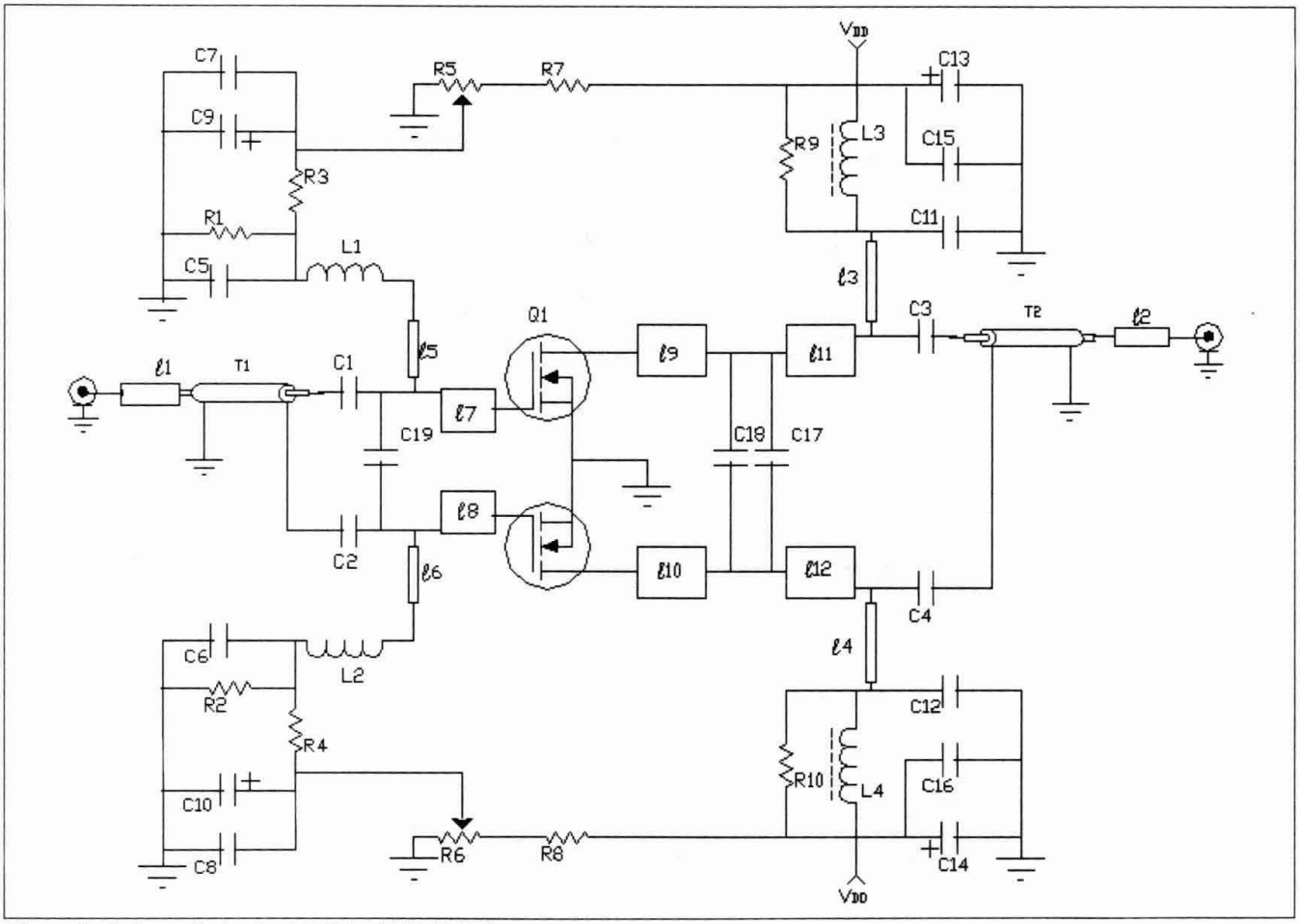

Figure 6. Schematic for f = 1.5 GHz, PTF 10125.

ℓ1, ℓ2 Microstrip 50 Ω
ℓ3, ℓ4 Microstrip 70 Ω .250 λ1.5 GHzC18
ℓ5, ℓ6 Microstrip 80 Ω .080 λ1.5 GHz
ℓ7, ℓ8 Microstrip 9.5 Ω .138 λ1.5 GHz
ℓ9, ℓ10 Microstrip 7.7 Ω .096 λ1.5 GHz
ℓ11, ℓ12 Microstrip 7.7 Ω .045 λ1.5 GHz
C1, C2, C3, C4, C7, C8, C11, C12 Chip Cap 13pF
C5, C6, C15, C16 Chip Cap .1 µF
C9, C10, C13, C14, C20, C21 Capacitor (Tantalum) 10 µF
C17, C19 Chip Cap 2.0pF
Chip Cap 0.3pF
L1, L2 Chip Inductor 2.7 nH
L3, L4 Ferrite 4mm.
R1, R2, R3, R4 Resistor 220 Ω
R5, R6 Potentiometer 2K Ω
R7, R8 Resistor 10 Ω
R9, R10 Resistor 10 Ω
T1, T2 50 Ω Coaxial Balun

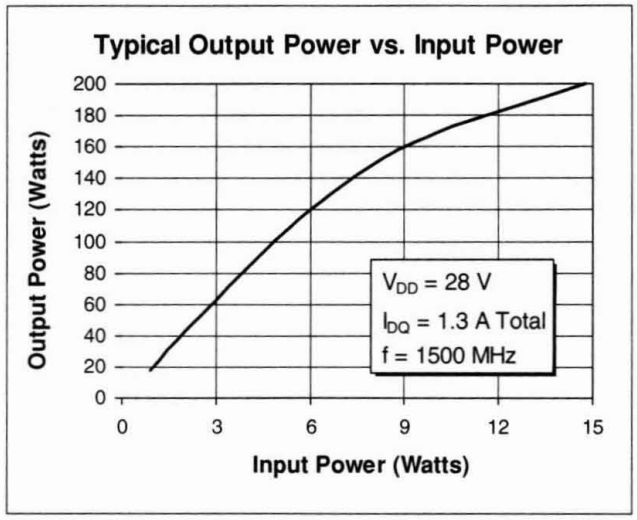

Figure 7.

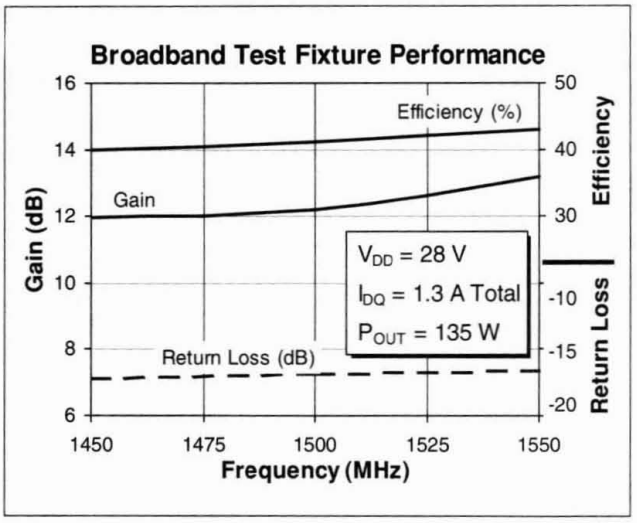

Figure 8.

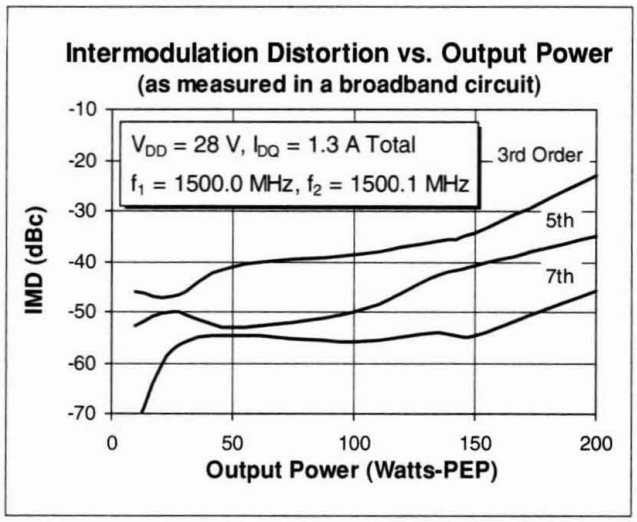
Intermodulation Distortion vs. Output Power
(as measured in a broadband circuit)
V_{DD} = 28 V, I_{DQ} = 1.3 A Total
f_1 = 1500.0 MHz, f_2 = 1500.1 MHz
3rd Order
5th
7th
IMD (dBc)
Output Power (Watts-PEP)

Figure 9.

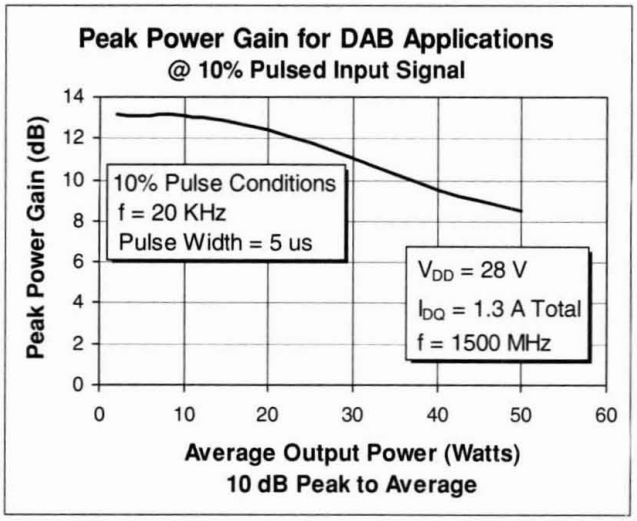
Peak Power Gain for DAB Applications
@ 10% Pulsed Input Signal
10% Pulse Conditions
f = 20 KHz
Pulse Width = 5 us
V_{DD} = 28 V
I_{DQ} = 1.3 A Total
f = 1500 MHz
Peak Power Gain (dB)
Average Output Power (Watts)
10 dB Peak to Average

Figure 10.

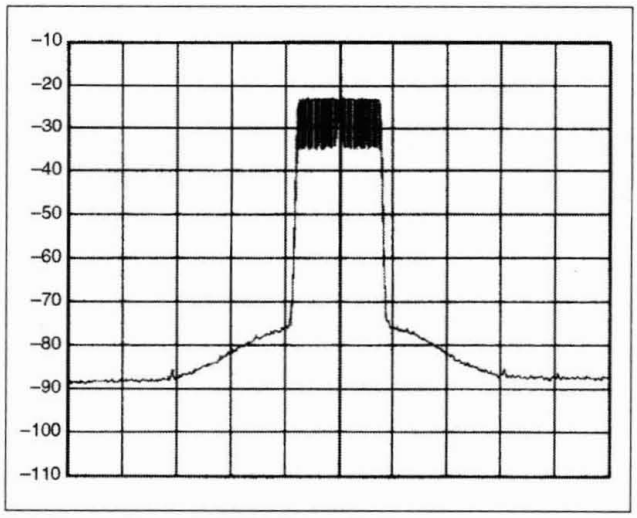

Figure 11. Center 1.5 GHz, span 10 MHz.

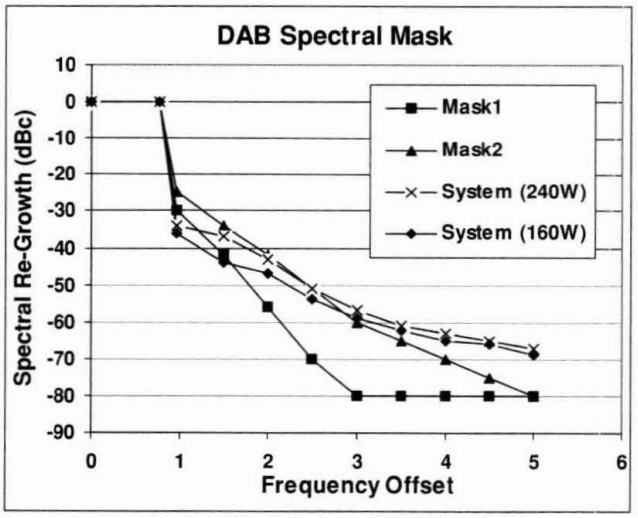

Figure 12.

Figure 11 shows the actual DAB spectra at 3 watts. Figure 12 is the plotted spectrum vs. the BBC critical and non-critical masks.

A small (60 watt DAB, 250 watt (peak)) amplifier was configured as shown in figure 13. Testing of the final stages as a separate unit, and subsequently with the driver stage, showed no discernable change in spectral regrowth.

Figures 14 and 15 are the spectral, and spectrum vs. mask plots of the combined output of the small DAB test amplifier.

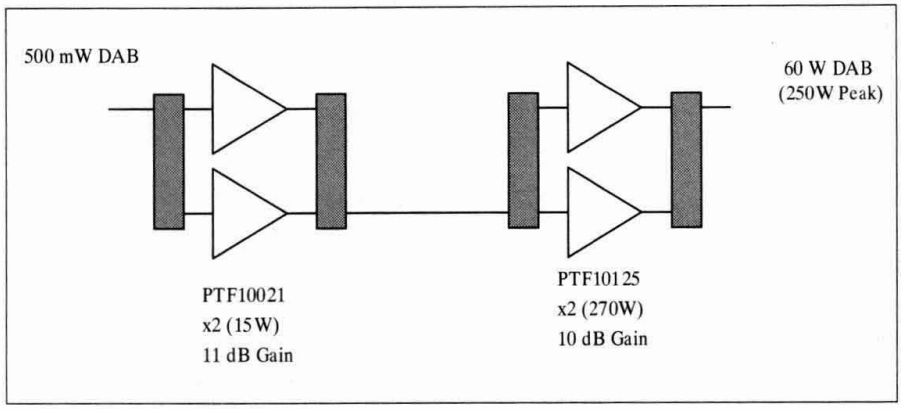

Figure 13.

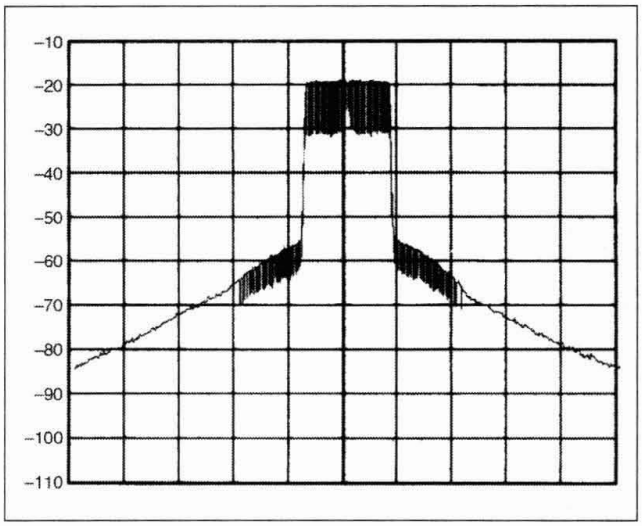

Figure 14. Center 1.5 GHz, span 10 MHz.

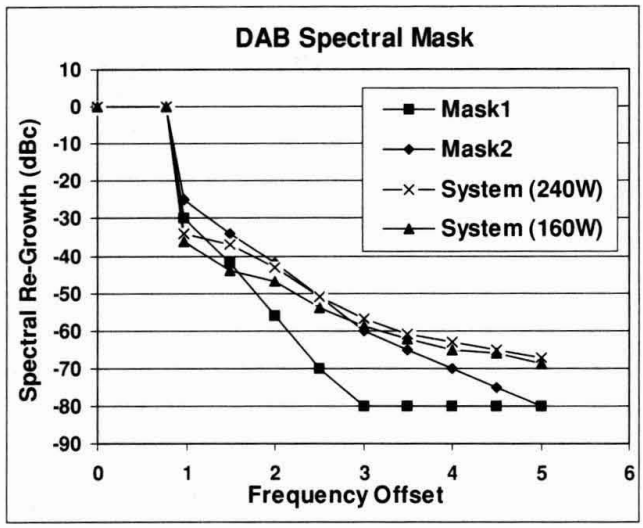

Figure 15.

Figure 15 shows plots of the DAB signal at two different power levels. Assuming that the non-critical mask may be used, and that the lower power level is produced, only a band-pass filter will be required. In the case of the critical mask (assuming no reduction in output power), the feed-forward system will be required, and as expected, a band-pass filter will be needed to fully comply with the mask requirements. Figure 16 shows a suggested line-up for a 1 KW (peak)/240 W DAB amplifier. Our final step in scale was to scale up to the 1 kW (peak) amplifier shown in figure 16. Our test system was reconfigured with additional PTF 10125 stages, and high power attenuators to emulate the system shown in figure 16 as closely as possible under laboratory conditions.

Figure 17 shows the DAB spectrum at 240 watts. Figure 18 shows plots of the DAB signal at 2 different power levels. Due to the high degree of back-off, the added stages have little negative impact on performance.

Conclusion

LDMOS has become the new standard in high performance, high linearity applications. The high gain and low packaging parasitics inherent in the technology have allowed LDMOS to easily out-perform competing technologies. The technology has matured over the past few years, allowing system designers to find easy-to-use high performance devices that are extremely rugged and cost effective.

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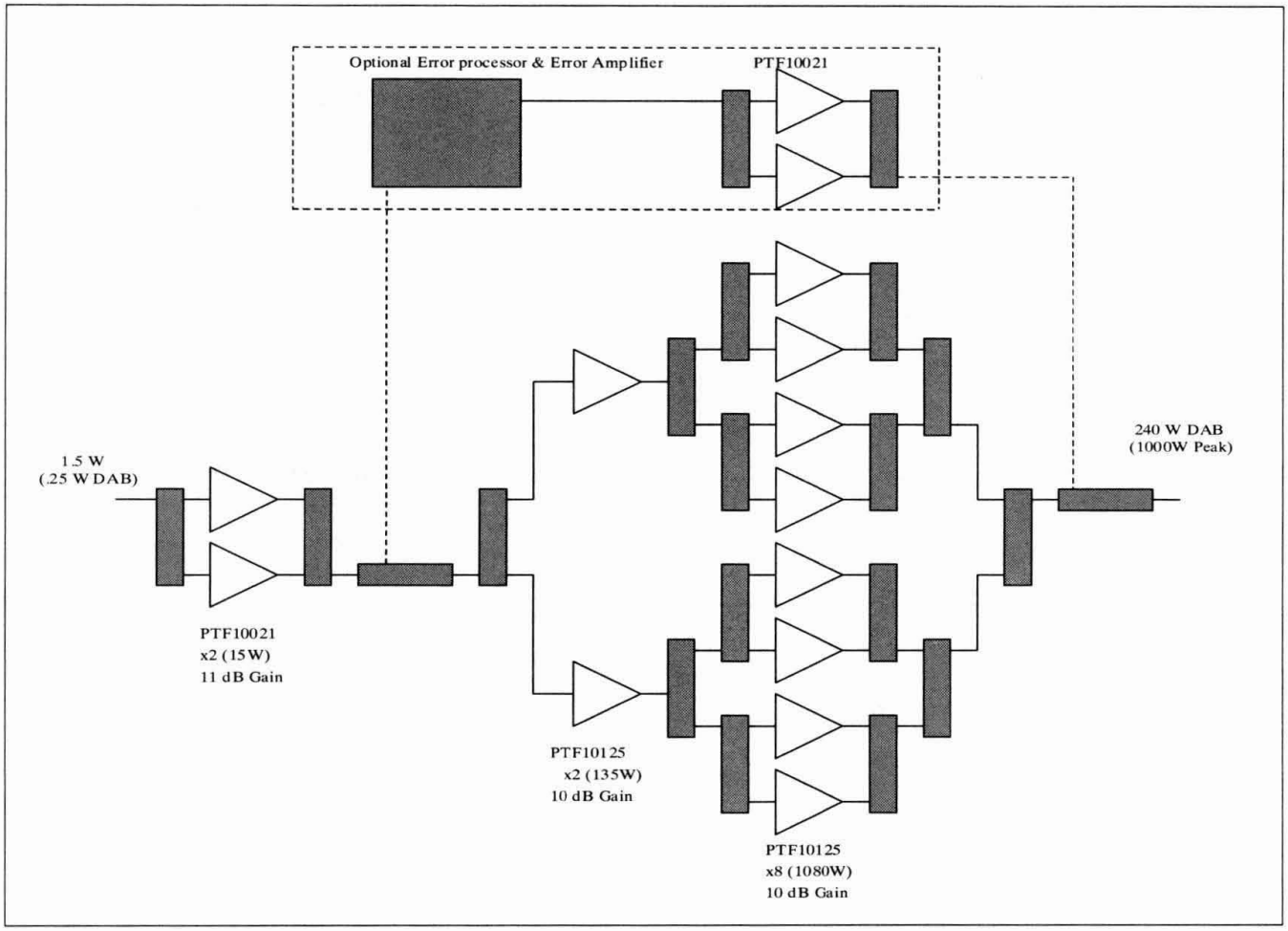

Figure 16.

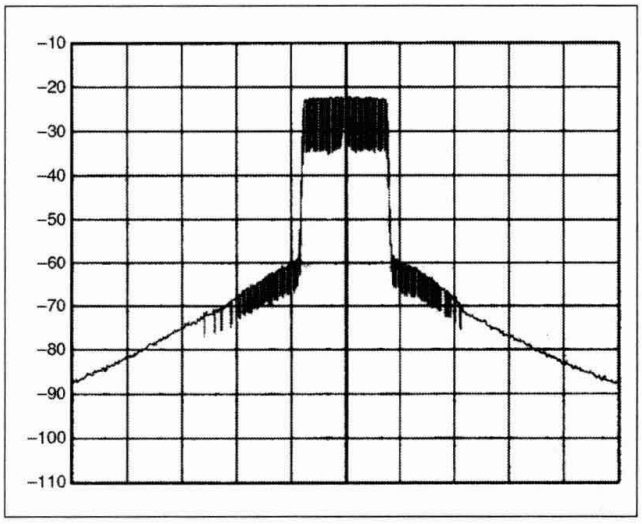

Figure 17. Center 1.5 GHz, span 10 MHz.

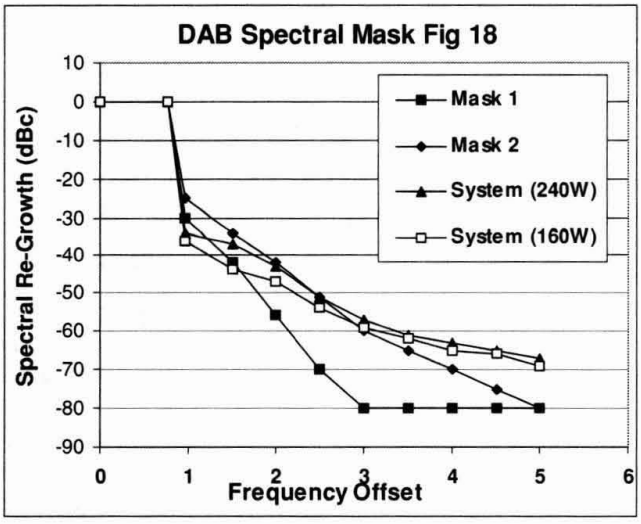

Figure 18.

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LZT 123 3114 R3
February 2000

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